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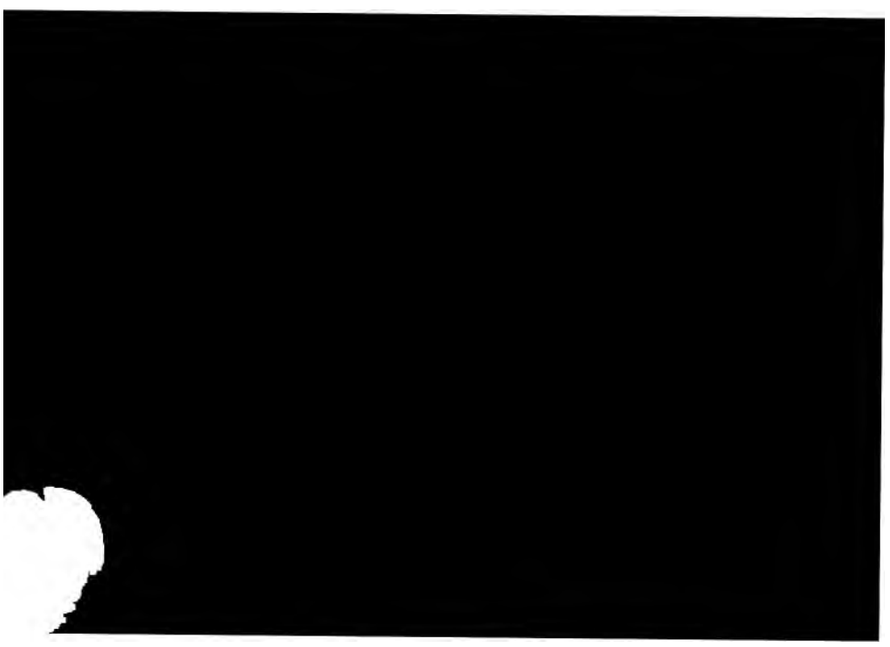

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CALIFORNIA WATER BIRDS. No. II.—VICINITY OF MONTEREY IN MIDWINTER.*

BY LEVERETT M. LOOMIS,

Curator of the Department of Ornithology.

[With Plate i.]

The present paper is based on observations made between the 11th of December, 1894, and the 13th of January, 1895. As upon former occasions, a little cove at the Hopkins Seaside Laboratory was the starting point in my daily excursions on the bay and ocean. The Laboratory was again the place of indoor work, one of the buildings, through the courtesy of the directors, being used to prepare specimens in. According to local information the weather was unusually stormy during my visit. This, however, was not a drawback, for there was only one day when it was deemed unsafe to venture out on the water. There were a few days when the sea was as calm as any time in summer. Although it was the rainy season (it rained on fourteen days of my stay), the climate was more agreeable than in summer, as there

* Pages 1-14 read at the Thirteenth Congress of the American Ornithologists' Union, held in Washington, D. C., Nov. 11-14, 1895.

NATURAL HISTORY

were no penetrating fogs. With green grass, flowers blooming in every yard, strawberries on the vine, it was difficult to realize it was winter, although the higher mountains in the distance were whitened with snow.

The surprises that await the student of birds invading an unworked field were not wanting in the present instance. Some species that were confidently expected were not found and others that were not even thought of as winter birds proved to be more or less common. It was fully anticipated after the experiences of August that the three Jaegers and Sabine's Gull would occur as winter residents, but not a single individual of any one of these species was seen. It is scarcely to be supposed that the tide of their migration passed wholly by Monterey, or, on the other hand, that it had receded northward. Doubtless the locality was within the winter range of some of them at least, the local centers of distribution being to the northward and southward.

MIGRATION.

A greater surprise than the absence of the boreal birds mentioned was the presence of the Black-vented* and the Dark-bodied Shearwaters. Thousands of the former

waters were seen passing down the coast. The movement was still in progress at the time of my return to the land. As in the case of the migrants early in the season, they followed the shore-line. Appearing from the northward, singly and in companies, they passed swiftly by and disappeared to the southward. At Point Pinos the inner edge of their path of flight was not more than half a mile from the shore. Three males and a female were secured. Accompanying the Black-vented were a few Dark-bodied Shearwaters. A half a dozen were identified, one of them being captured.

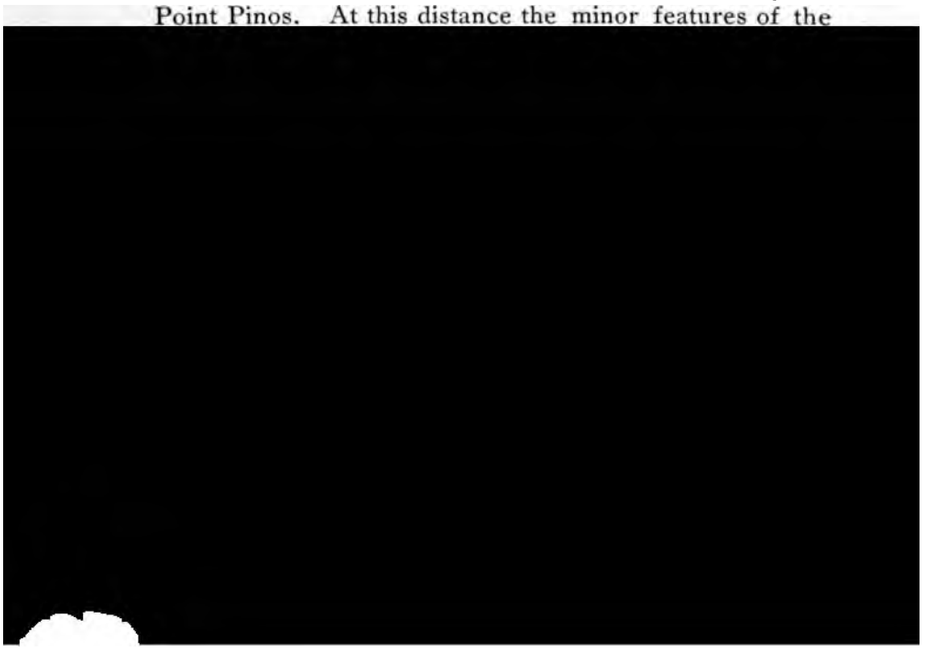
On the 18th I was again far enough out from land to be in the path of migrating Shearwaters, but only two were observed, a Black-vented and a Dark-bodied. Both were heading southward. On the 20th, after a heavy gale, a Dark-bodied Shearwater was shot as it was flying over the bay about a mile offshore midway between the Laboratory and Monterey. As I did not go out toward Point Pinos it was not ascertained whether there was a movement in progress.

About fifty Black-vented Shearwaters were seen during the forenoon of December 31st. They came from the northward, straggling along at intervals, and without pausing passed quickly out of sight down the coast. It was clear and they kept well off from the land—from three to five miles at Point Pinos. A female was the only specimen taken. The organs of reproduction in this bird were functionally enlarged, which was not the case in the examples obtained on the 14th.

January 2d two Black-vented Shearwaters were seen. They were flying southward. No others were met with between Dec. 31st and Jan. 10th, although trips were made outside of the bay on six of these days. Much of this time the weather was unfavorable for migration. A

great storm occurred on the 4th.* On the 10th, 11th, and 12th (the last days observations were made) the sea was very still, and many Black-vented Shearwaters were migrating. On the morning of the 10th, between eight and nine o'clock, individuals and small companies to the number of about five hundred passed southward by my station two or three miles northeast of Point Pinos. During the remainder of the forenoon only a few were observed. Several were found resting on the ocean early in the afternoon. During the closing hours of the day another flight of these Shearwaters took place, several hundred being seen. When I left the ocean at sundown it was still under headway. Most of them passed Point Pinos between three and four miles offshore. None were noticed nearer to it than a mile or further out than six miles.

The sky was cloudless and the ocean like glass all day long on the 11th. In the forenoon about two thousand Black-vented Shearwaters were seen going south. The height of the movement was between eight and quarter past ten. During the latter half of the afternoon about a thousand more were observed. Both forenoon and afternoon I went out on the ocean fully six miles beyond Point Pinos. At this distance the minor features of the



for several miles. It was distinctly seen that their course conformed to the trend of the shore, bearing to the east at Monterey Bay and to the west off Point Pinos. There were no large flocks, but at intervals there was quite a continuous stream of individuals and little parties. Four Dark-bodied Shearwaters were noticed—single birds migrating in company with the smaller species.

Only the forenoon of the 12th was spent upon the water. Nearly as many Black-vented Shearwaters were found migrating as on the previous day, but they were not so far at sea, there being a haziness of the atmosphere that obscured the coast-line.* The bulk doubled Point Pinos from one to two miles from the shore. The movement continued the whole forenoon, but its height was at nine o'clock when quite a rush occurred. A Dark-bodied Shearwater was taken and four others were seen. They appeared singly with individuals of the lesser species.

The sexual organs of the eight Black-vented Shearwaters that were secured on these three days were in an advanced stage of erotic development. The larger testis of one male measured (in inches) .32 x .47 and of another .38 x .53. The ovaries of the females exhibited a corresponding development. Not the slightest indication of similar functional activity was detected in other species, although hundreds of specimens of Auks, Gulls, Fulmars, etc., were examined.

The beginning of the migration of these Shearwaters was apparently witnessed Aug. 27th, the last day of observation in the summer expedition. In January, the migration was evidently drawing to a close, the breeding

* In the preceding paper I have frequently referred to the deflection toward the land of the path of migration in the Dark-bodied Shearwater and other pelagic species when the guiding coast-line was hidden from view by low-hanging fogs. The migration of a species may be almost interpolar in extent and still be modified by local conditions.

season being at hand. It is noteworthy that the specimens obtained previous to Dec. 31st did not show the enlargement of the reproductive organs.

The Dark-bodied Shearwaters observed were seemingly stragglers bringing up the rear in the southward migration of the species, this migration apparently commencing during the latter part of June. The ovary and testes were undeveloped in the female and the two males taken, which would seem to indicate that they were not going to breed. It may be such loiterers furnish the instances of early return of 'barren birds,' the Fulmars noted in the previous paper perhaps being examples from Arctic regions.

The range of the Black-vented Shearwater has been but imperfectly defined, even the fact of its abundance off the coast of middle California remaining unknown until my recent investigations. In the light of the winter migration discovered, it seems probable that this species extends to the boreal latitudes reached by its Dark-bodied congener, which has been reported on the Asiatic side from the Kurile Islands (Salvin, 'Ibis,' 5th ser., vol. vi, p. 355). At the antipodes this latter species is affirmed to nest on the Chatham and other isles in New Zealand seas, its habitat apparently extending as many degrees south as north of the equator. The condition of the gen-

the Greater and Sooty Shearwaters do not rear their young during the sojourn on the North Atlantic.*

The Black-vented Shearwaters at Monterey were undoubtedly migrating to a breeding habitat further south. While their destination may have been north of the equator, it seems highly probable that they did not stop short of the Southern Hemisphere. There was ample time for migration to the South Temperate Zone, for they were speeding southward at a rate apparently equal to that of the fastest express train. Continuing their flight half of each day, a few days would suffice to cover several thousand miles. If reproduction was postponed until February, the height of the season in Wilson's Petrel on Kerguelen Island (Eaton, Philos. Trans. Roy. Soc. London, vol. 168, p. 134), over two weeks might elapse before it would be necessary for the Monterey migrants to be on their breeding grounds.†

A collation of the facts bearing upon migration scattered through the two volumes of Sclater and Hudson's 'Argentine Ornithology' reveals that migratory movements occur in South America similar to those in North America, southern winter with its failure of food forcing the birds to move toward the equator. The transmigration from the northern continent, however, has no corresponding parallel in the southern.‡ The smallness of the area to be depopulated south of the Tropic of Capricorn seemingly explains the absence of such migration, there being no need for retreat to antipodean temperate latitudes to

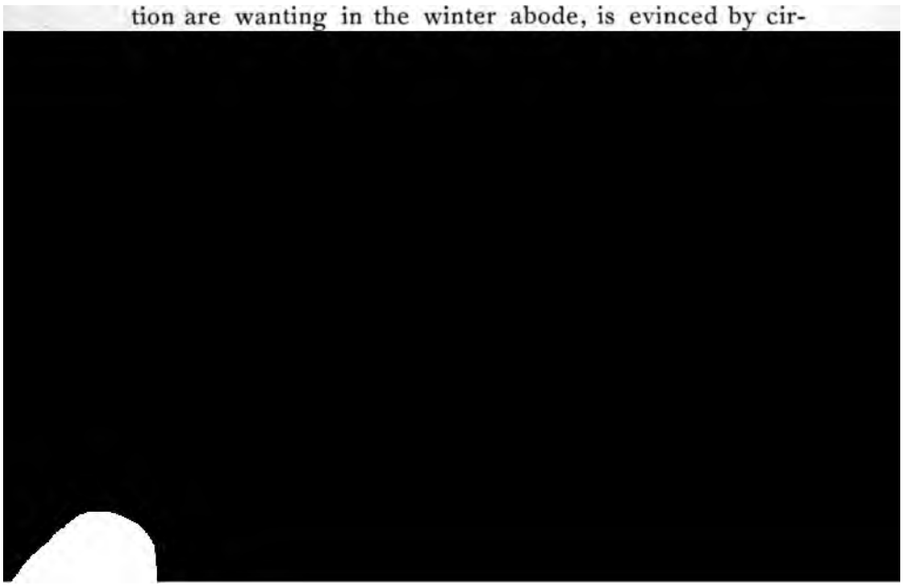
* The Pink-footed Shearwater and several other members of the order Tubinares should be included with the species occurring but not breeding, so far as discovered, on northern waters.

† A greater length of time might transpire, for the nesting season is protracted through the southern summer into March in the Dark-bodied Shearwater (Buller, l. c., p. 232).

‡ Nevertheless, it may be that there is some migration of indigenous birds from temperate and tropical South America extending to tropical North America.

avoid over-crowding. Upon the ocean opposite conditions seem to prevail. The necessity for migration appears to be greater on southern than northern seas, for the frigid waters of the Antarctic encroach upon the South Temperate Zone. It is not remarkable, therefore, if Petrels in their flight from the dearth of winter penetrate into the Northern Hemisphere as far as Pomarine and Parasitic Jaegers and North American Limicolæ penetrate into the Southern.

That the rear guard was present in December and January does not disprove that the Shearwaters came north to escape from winter famine. If the end of their journey was in the remote southern regions, the mild climate of the California coast would be exchanged for the inhospitable Antarctic summer. Further, if the interval occupied by reproduction be the limit of the sojourn in the breeding habitat, as is true in numerous species visiting boreal climes, most of the year would be spent on warmer seas to the northward. The vexed question, why some birds migrate from tropical and temperate to colder latitudes to rear their young, arises when inquiry is made why the Shearwaters do not breed on California shores. That migration is not satisfactorily explained on the score that the conditions of temperature essential to reproduction are wanting in the winter abode, is evinced by cir-

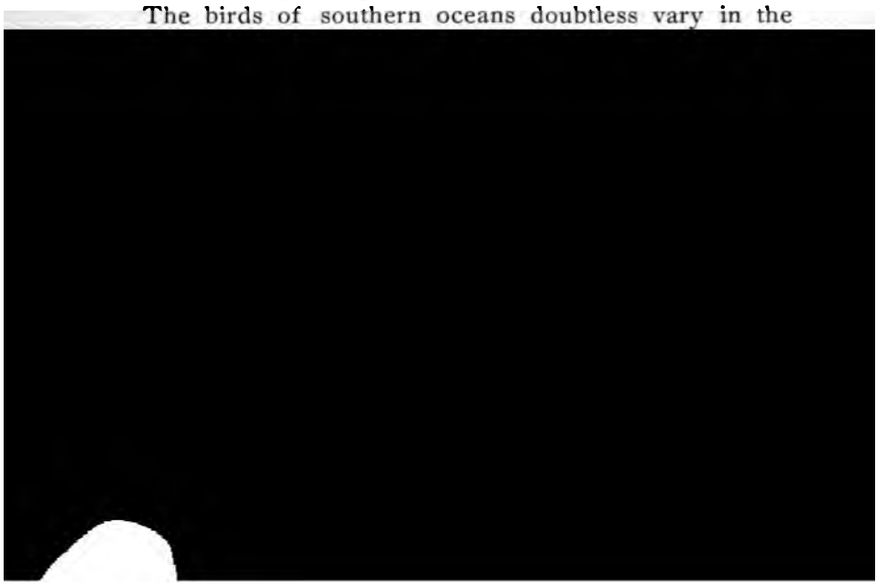


Provided there was sufficient time before the Auks, Gulls, and Cormorants breed for the Shearwaters to bring up their young on the islets along the middle coast of California, there would not be room for the great hosts that in all probability were winging their way southward in September, October, and November. Many places too that are tenantable during summer are not so in winter, the sea breaking over them in stormy weather. The congregating of hordes of Gulls upon the islets is a further barrier. In the colder boreal regions means of sustenance are lacking in winter, and off Lower California there is apparently accommodation only for 'residents' and perhaps for some migrants from the tropics, for breeding begins earlier than further north (for example, during the latter part of December in the Man-o'-War Bird—Bryant, Proc. Cal. Acad. Sci., 2d ser., vol. ii, p. 263), but south of the Tropic of Capricorn summer has opened new territory for habitation. As stated in the previous paper the vicinity of Monterey affords subsistence in summer far in excess of the requirements of the breeding population, owing to the absence of suitable places for rookeries. It naturally follows that birds come south and enjoy this bountiful store after the cares of reproduction are over, returning north when their breeding grounds become habitable again. Hence it is not extraordinary if the Shearwaters, knowing the way by previous experience, resort to an inclement region having nesting accommodations, although available only for a brief period. In short, it is held that the return of all birds to the region of their birth is a physical necessity, there being no room for them to rear their young anywhere else.*

* Stragglers it is true might loiter by the way, but if the majority of migrants were uncertain in their destination over-crowding must inevitably ensue. Perhaps the occupancy of rookeries affirmed to take place in advance of the breeding season prevents aliens from securing a foothold.

It is the custom of writers upon the migration of birds to speak of the tropics as a region of superabundance of food capable of permanently supporting the migrants that come from colder climes. If this was really the case, after the departure of these birds to their nesting grounds there would exist a vacuum that would remain unfilled until their return. That such a void occurs anywhere in nature is not sustained by fact. "Living space is always at a premium," life seeking an entrance wherever there is a possibility. What compensation there is from the Southern Hemisphere for the departure of northern birds is not definitely known, for no trained students of migration have been on the ground to enquire fully into the matter. This much, however, has been ascertained, that some birds of the South Temperate Zone extend their northward flight into the tropics, and that there is some migratory movement in species restricted to tropical regions. (Cf. Hudson, 'Argentine Ornithology;' Chapman, Bull. Am. Mus. Nat. Hist., vol. iv, p. 284, vol. vi, p. 14; Ridgway, Rep. U. S. Nat. Mus. for 1890, p. 267; Nuttall, Man. Orn., 2d ed., Land Birds, p. 27.) Below the Tropic of Capricorn migration toward the southern pole and summer seemingly prevent deficiency of food through the presence of North American birds.

The birds of southern oceans doubtless vary in the



Monterey ('No. 1,' p. 180 et seq.), or of the Louisiana Water-Thrush in the mountains of South Carolina ('Auk,' vol. ix, p. 34). It is obvious that winter compels the evacuation of Antarctica and that transmigration and early summer displacement in regions of plenty, making room for birds from further south, would prevent over-crowding on austral seas just as the general swaying of bird life toward the equator does in the Northern Hemisphere and on the continent of South America.*

While there is great diversity in migratory movements, the general effect of migration is that the bird population, as a whole, is shifted southward when winter reigns in the Northern Hemisphere and northward when it has its domain in the Southern. (See my remarks on this point in 'The Auk,' vol. xi, pp. 100–102.)

In January, the near approach of the season of reproduction compelled the immediate return of the Black-vented Shearwaters to their nesting haunts.† Desire for

* If there proves to be migration of some birds breeding in the tropics to the temperate zones during summer, the pressure from the hemisphere having winter would reasonably account for it.

It is not impossible that there exists a double migration in some pelagic species, southern-born birds migrating north and spending the summer in the home of the northern-born representatives of the species, breeding birds of the Northern Hemisphere and those seeking refuge from the scarcity occasioned by southern winter occurring at the same time in the same region. A migration of this kind would account for birds in latitudes higher than the breeding range independent of retrograde movement. It should be added that Mr. Hudson explains the presence of boreal Sandpipers all the year round in Argentina by a similar, though less protracted migration, summer birds coming from the Arctic and winter ones from the Antarctic (l. c., vol. ii, pp. 187, 191).

† The December and January Shearwaters and other late migrants, like north-bound boreal Sandpipers on the Florida coast in June (Scott, 'Auk,' vol. vi, pp. 156–159), not improbably penetrate into the higher latitudes, and in consequence delay their journey until summer has become dominant. Such migrants, however, are only stragglers, the vast hosts crowding closely upon the retreat of winter.

procreation in migratory birds is doubtless a stimulus in the return-journey. That there is, however, above and behind this a deeper incentive, is manifested through early summer migration southward, as in the California Murre. The physical necessity exists for alternate depopulation and repopulation of the Northern and Southern Hemispheres as winter holds the supremacy in either. The adaptation of birds to this physical necessity is migration. Two prime factors enter into the adaptation—the past and the present. That the inheritance from the past amounts to anything more than the immediate urgency requires, the facts of migration apparently do not evidence. While migration may have originated with the Glacial Period or more remote secular refrigeration, and have been the adjustment to the conditions that existed then, the present adjustment meets the conditions of winter as they exist now. In brief, it is maintained that all the diverse movements constituting migration are the outgrowth of time and are enforced by the present need of adjustment of population to food-supply.* On one hand there is intelligent* adaptation on the part of the birds to the present necessity for migration, on the other hand there is probably a hereditary disposition for travel

the nesting homes when summer has made them habitable.*

How oceanic birds find their way to isolated islands should at least receive passing notice. My observations on the early southward movements ('No. 1,' p. 183 et seq.) show that the Dark-bodied Shearwater and other highly pelagic species followed the coast-line in migrating in the same manner as the Northern Phalarope. While this circumstance does not prove that landmarks enable the Yellow-billed Tropic Bird to reach the Bermudas (Reid, Bull. U. S. Nat. Mus. No. 25, p. 263) or the two migratory Cuckoos of New Zealand (Newton, Dict. of Birds, p. 567; Buller, l. c., vol. i, pp. xli, 129, 133) to find their way to their winter quarters, it does prove that pelagic birds are not guided by a mysterious sense of direction, but by natural phenomena. To what extent ocean currents and winds direct is not known, for no one has studied the subject. As birds are highly sensitive to changes of temperature,† the warm waters of the Gulf Stream may guide the Yellow-billed Tropic Birds until the Bermudas may be sighted from a considerable elevation. The East Australian Current may direct the New Zealand Cuckoos in their aërial voyage.

In the report on the Procellariidæ collected during the 'Challenger' expedition (Voy. Chal., Zoöl., vol. ii, p. 147) it is stated of the Short-tailed Albatrosses that "they followed the ship every day in numbers till we got into the trade-winds, when no more were observed." Per-

* Possibly there may be a deeper insight—an intelligent appreciation of the necessity of migration. The psychological aspects of migration are presented at greater length in my paper in the 'Auk,' vol. xi, pp. 112–117.

† Often in my experience in upper South Carolina has the end of a cold spell been foretold by the birds when there was no apparent indication of milder weather. Suddenly Carolina Wrens and other choristers of winter would break the stillness with their hearty songs, proclaiming the change that was soon to follow.

haps such winds may to some extent be a factor in the wandering and migratory movements of birds over the deep.

Fishermen know the breeze is coming when landsmen can detect no sign of it. The Yuma trailer performs feats that would be incomprehensible to a Broadway business man. Is it passing strange that migratory birds whose very existence depends on their being able to find their way to their winter and nesting abodes should have their faculties so keenly developed as to discern guiding marks where our duller senses perceive only a pathless sea?

GENERAL OBSERVATIONS.

Æchmophorus occidentalis. WESTERN GREBE.—The closing weeks of summer gave promise that Western Grebes would be plentiful later in the season. This promise was abundantly fulfilled, numerous companies of them being found at times on the bay during my winter visit. They were very unsuspicious, and, if specimens had been desired, line shots would often have yielded several.

Colymbus holbœllii. HOLBŒLL'S GREBE.—This species was apparently uncommon, for a female obtained Dec.

Colymbus nigricollis californicus. AMERICAN EARED GREBE.—The American Eared Grebe appeared to be the most abundant member of the family in the vicinity of Monterey. They were usually found in little companies, and were very tame, allowing the boat to come quite near before diving.

Podilymbus podiceps. PIED-BILLED GREBE.—Only one Pied-billed Grebe was seen, and it was captured, being shot from the shore at the Laboratory. As but little collecting was done at the surf, the apparent scarcity of this species may have been due largely to lack of observation in proper situations.

Urinator imber. LOON.—A female was taken on the day of my arrival at one of the reservoirs that supply the towns of Pacific Grove and Monterey with water. I was informed that this bird had been on the reservoir for several weeks, and had become quite fearless, no one having molested it. I did not satisfactorily determine whether this species occurred with the other Loons on the bay and ocean.

Urinator pacificus. PACIFIC LOON.—The great number of Loons passing and repassing up and down the coast is one of the striking features in the bird life at Monterey in winter. So far as could be judged without making a systematic slaughter, the present and the following were the only species represented. They were seemingly about equally abundant.

Urinator lumme. RED-THROATED LOON.—On the water both *pacificus* and *lumme* were wary, diving when approached before they were within reach of gun shot. It was not difficult, however, to secure either on wing, for individuals were continually flying by within range.

A male (No. 1910, Coll. Cal. Acad. Sci., Mowry's,

Cal., Jan. 5, 1882) has the back narrowly reticulated with white. This specimen is distinguishable at a glance from the winter examples of *pacificus* in the collection by the streaking on the pileum, which appears to be a diagnostic character in *lumme*.

Cerorhinca monocerata. RHINOCEROS AUKLET.—Solitary Rhinoceros Auklets on the water near the shore were the only ones observed previous to the forenoon of January 12th, when there was quite an extensive movement. The birds appeared in pairs from the northward, and passed down the coast without halting. A number of the specimens taken during my stay had patches of hardened asphalt on the lower parts. This substance was also found on numerous other birds, particularly Auks and Fulmars. One California Murre had its breast and abdomen completely encased and its wing feathers firmly glued together. The unfortunate bird was very lean, probably being unable to secure food in its helpless condition. Mr. A. W. Anthony has explained how the birds get the asphalt on their plumage. He states ('Zoe,' vol. iv, p. 365) that small, soft sticky blotches, from a submarine source, occur floating on the surface of the sea,

Lunda cirrhata was not met with. Its absence is attributed to local distribution.

Ptychoramphus aleuticus. CASSIN'S AUKLET.—Comparatively few were seen near the land. Offshore, however, they were common, particularly upon the ocean.

The exposed culmen in eight specimens in a series of twenty-two exceeds .75 inches, in two extreme examples reaching .83. Ten individuals (summer and winter birds) of the same series have the throat decidedly paler than the chin and jugulum. In a female (Aug. 7th) it is almost pure white.

Synthliboramphus antiquus. ANCIENT MURRELET.—About five hundred yards from the surf, a belt of drift kelp, extending from the Seaside Laboratory around Point Pinos, had gained an anchorage on the rocky bottom. The narrow strip between this breakwater and the beach was the favorite resort of Ancient Murrelets, except on the rare days when there was a north wind, which invariably drove the bird life of the bay away from the exposed south shore. A good many were also found near the surf in the little coves in the direction of Monterey and some were seen several miles out from the land. In the sheltered places they chiefly frequented food appeared to be abundant. They were great divers and swimmers under water, and voracious in their pursuit of small fry, occasionally driving the fish to the surface in the eagerness of the chase. Often not a Murrelet would be in sight for some time. Then a pair or a small company (the largest one observed numbered nine individuals) would suddenly appear from the depths. Unlike the Marbled Murrelets, they did not generally seek safety in flight when pursued. Neither did they dive as soon or remain as long under water when keeping out of the way

of the boat. If a white cap developed near them they would always escape from it by diving. Although over a hundred were taken in the narrow belt near the surf, they were more numerous there toward the last than at the outset, new birds apparently coming in to take the places of those that had been shot.

That this little Auk leaves its summer home in the land of icebergs and comes south in considerable numbers in winter to California has not been generally known to ornithologists, the single specimen taken by Dr. Dall off Monterey in January, 1874, and reported by Dr. Stejneger (Proc. U. S. Nat. Mus., vol. ix, p. 524) apparently being the only one recorded from this coast.

Many of the one hundred and two specimens preserved exhibit in a large degree the plumage ascribed by the books to the nuptial season. About half the birds of the series have the black throat patch. In the majority of them the black is more or less mixed with white. In several, however, it is uninterrupted and in a dozen others there are only a few stray white feathers. All of these specimens have to a greater or less extent the streaks on the upper back and indications of the latero-occipital stripes. In several examples the latter are well developed. On the sides beneath the wings the black prevails in numerous cases. With perhaps the exception of a few

Several specimens of the collection have but one foot, the other having been severed some time before their capture, the stump being entirely healed. A like circumstance is mentioned in the 'Water Birds of North America,' vol. ii, p. 505.

Brachyramphus marmoratus. MARBLED MURRELET.— Although common, they were not as plentiful the middle fortnight of my stay as at the beginning and during the closing week, when an extensive flight from the northward, lasting several days, passed Point Pinos. The birds flew in twos and threes, appearing at short intervals during the hours the movement was at its height.

The greater part of the specimens obtained have the interramal space to a varying extent mouse gray. In several the feathers of the dorsal region are narrowly tipped with white, presenting a somewhat squamous appearance.

Cepphus columba. PIGEON GUILLEMOT.—A single male, taken Dec. 12th, was the only 'Sea Pigeon' met with during my visit.

The lower parts of this specimen are immaculate white with the exception of a few drab feathers on the breast and abdomen and a collar, about an inch in width, of blended drab and white. This collar, with a deeper shade of drab, extends around the back of the neck and encroaches upon the occiput where it branches off into imperfect superciliary stripes. There are only faint traces of white on the crown. The wing-patch is as fully developed as in a bird of the breeding season.

Of nineteen summer adults from Monterey, all except two display more or less white on the under surface of the wings. This is likewise true of the remaining three adult summer birds in the Academy's collection, from the Farallones, Alaska, and East Siberia. In several specimens the white forms conspicuous patches. In the ex-

treme example of the series (♀ ad., Monterey, Cal., July 28, 1894) the inner edges of the primaries are broadly margined with it, when the wing is closed forming a patch, partially concealed by the under coverts, one and a fourth by one and a half inches in diameter. An equally large white area occurs on the under coverts near the edge of the wing somewhat over an inch below the carpal joint.

Uria troile californica. CALIFORNIA MURRE.—The facies of the bird life of the bay and ocean was continually undergoing change. Species would be present in force and afterward almost entirely absent for a while, shifting their quarters as the inhabitants of the woodland are wont to do from day to day in winter. There were, also, extensive movements up and down the coast. Some of these perhaps had more than local significance. The flights of Marbled Murrelets and Rhinoceros Auklets previously alluded to may have been tardy migration from stormy seas to the northward, followed a little later by a return movement; such migration being like that of the Horned Larks and Longspurs with the advance and retreat of the snow. The passages of the California Murres were especially interesting, for they furnished additional proof that the movements witnessed in June and July

From the outset a large proportion of the Murres seen had the sides of the head and neck, the throat, and fore-neck brown—a state of plumage the books describe as peculiar to the season of reproduction. Four examples at hand (three males and a female) differ only from the June birds in the collection in being unworn and unfaded and in having the feathers of the upper parts not tipped with a lighter color. Of the four white-throated specimens preserved, two females and a male have a brown collar on the fore-neck. The chin in each is brown to a varying extent and the white of the throat more or less mottled with the same color. The fourth example (a male) has but faint traces of the collar and the throat is chiefly pure white. The white latero-occipital stripes scarcely invade the cervix in one of these specimens, and the dark markings on the sides and flanks are distinct in all of them.

Two August young-of-the-year in the collection of the Academy are immaculate white below, save a little dark drab-gray in the interramal space. An adult male (No. 7418, Aug. 10, 1887, San Francisco Bay, Cal.) shows a strong tendency to melanism, the white feathers of the lower parts being conspicuously margined with brownish drab. Indications of similar abnormal coloration exist in a winter example of *Uria lomvia* from Greenland in the American Museum of Natural History.

There is, also, in the Lawrence Collection of the American Museum a specimen (No. 46,093) of *Megalestris skua*, which has the following legend on its label: "*Stercorarius catarractes*. Calif.—off Monterey" (written in ink). "Presented by N. Pike, Esq." (written in pencil). This is doubtless the example referred to in Baird's Birds of North America, 1858, p. 838.

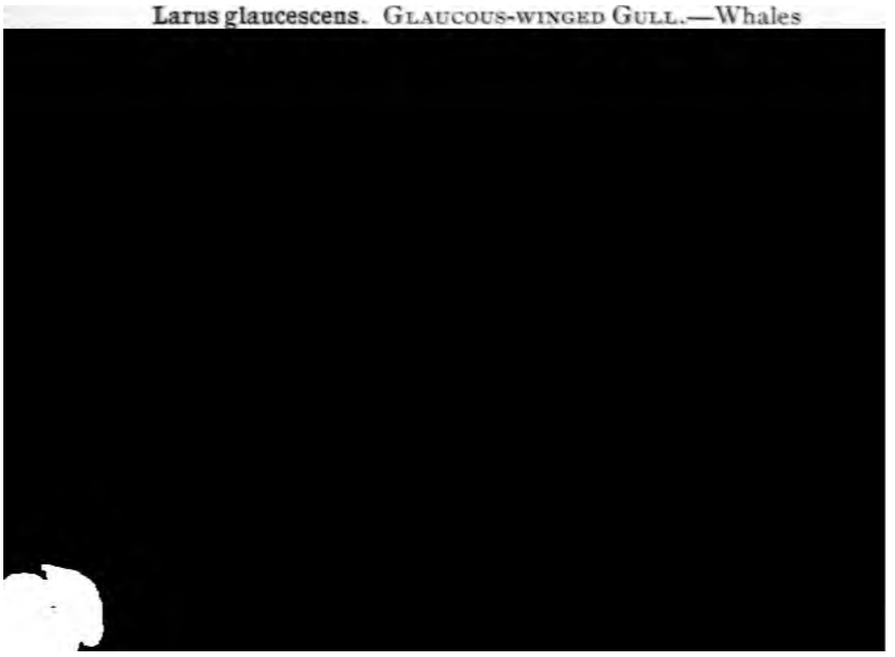
Rissa tridactyla pollicaris. PACIFIC KITTIWAKE.—Several hundred yards from the outer rocks at Point

Pinos there appears to be a natural petroleum well in the ocean, and on stormy days the oil on the troubled waters prevents the waves from breaking over a considerable space. December 29th, returning from a three miles trip west of the Point against a strong southeast wind and a heavy cross-sea, we sought this spot to rest for awhile and watch the gulls as they came out of the bay and went down the coast. In one little flock that passed near by there was a Pacific Kittiwake, which came close to the boat when a dead Gull was tossed overboard as a decoy. It proved to be a young female, and was the only example of the species obtained during my stay.

Larus glaucus. GLAUCOUS GULL.—An immature male, shot Dec. 19th, is referred to this species (not to *barrovianus*), it having the following dimensions, in inches: Length, 27.50; chord of wing, 18.30; chord of exposed culmen, 2.40; depth of bill through angle, .82; depth at base of exposed culmen, .92; tarsus, 2.80.

Dr. Cooper has previously recorded either this Gull or *barrovianus* from California under the name of '*Larus Hutchinsii*' (Proc. Cal. Acad. Sci., vol. iv, pp. 9, 10).

Larus glaucescens. GLAUCOUS-WINGED GULL.—Whales



All the adult specimens taken had the head and neck clouded with sooty gray. In two males and a female, however, the gray is restricted almost entirely to the upper surface of these parts. It is a notable circumstance that most of the examples of this Gull obtained at Monterey are females.

Larus occidentalis. WESTERN GULL.—Young Gulls of this species are very confiding. Frequently individuals alighted within a few feet of the boat, expecting something edible to be cast overboard, mistaking us for fishermen, who throw back into the water the undesirable part of the catch. So ravenous were all the Gulls that a scramble invariably ensued when I threw away the cotton used in wiping the blood from my specimens—the successful bird flying off with the coveted prize.

This species was among the most abundant of the Gulls. Individuals with immaculate white heads and necks were not uncommon.

Larus argentatus smithsonianus. AMERICAN HERRING GULL.—Estimating from the number of specimens taken on different days, this species and the following one were about equal in abundance. Both were apparently common over the bay and ocean and along the shore.

Larus vegæ. VEGA GULL.—In their excursions in and out of the bay many Gulls passed over the rocky point at the Seaside Laboratory, preferring to take the short cut across the land rather than the safer détour over the water. Several afternoons, when my assistants were short of material to work upon, a series of American Herring, Vega, and other Gulls were shot at this spot.

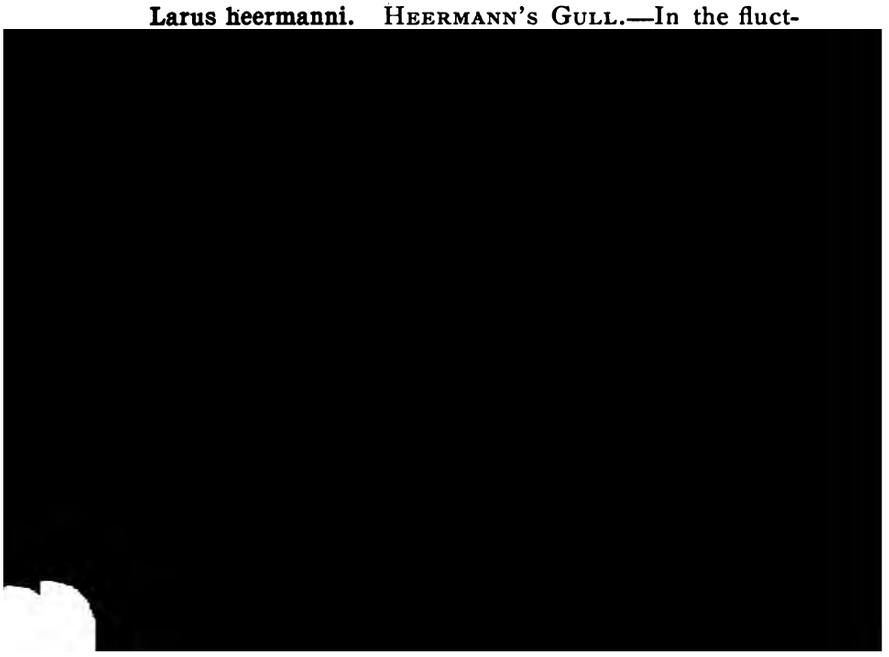
Larus californicus. CALIFORNIA GULL.—This is *par excellence* the Gull of lesser size of Monterey and vicinity in midwinter, sharing rank in the scale of abundance with its larger congeners, *glaucescens* and *occidentalis*.

Larus delawarensis. RING-BILLED GULL.—Apparently the Ring-billed Gull was not common in the neighborhood. Two females (one mature and the other nearly so) were the only examples I was able to bring back with me.

Larus brachyrhynchus. SHORT-BILLED GULL.—At times adult and immature birds were very common on the bay and ocean in the vicinage of Point Pinos. January 9th many were found on the sand-bars at the mouth of the Carmel River in company with the next species.

Larus canus. MEW GULL.—The geographic distribution of *Larus canus* is stated in the second edition of the A. O. U. 'Check-List' to be, "Europe and Asia; accidental in Labrador?" Nevertheless it appears to be common on this coast in winter. I took a number of specimens with me to Washington and Mr. Ridgway has corroborated my identification. It should be noted that Mr. Henshaw has reported this Gull from Southern California ('Auk,' vol. ii, p. 232) and Dr. Stejneger from the Commander Islands (Bull. No. 29 U. S. Nat. Mus., p. 76; Proc. U. S. Nat. Mus., vol. x, p. 123).

Larus heermanni. HEERMANN'S GULL.—In the fluct-



the bay near the Chinese fishing village. Upon no other occasion was the species met with.

Sterna maxima. ROYAL TERN.—This was the only Tern observed, and at intervals during my visit it was decidedly common. As a rule they did not decoy as readily as the Gulls. Any conspicuous bird thrown into the air, however, would usually cause them to fly around the boat in large circles. If one was shot its companions showed great anxiety and others were drawn to the scene, particularly if the bird was winged and made an outcry.

Immature birds lacked much of the silvery gray on the quills, the closed wing posterior to the greater coverts having a dusky aspect.

Diomedea albatrus. SHORT-TAILED ALBATROSS.—On my arrival, just after a storm, a few adults and birds-of-the-year were found close in shore on the bay. Dec. 20th two of the former were noticed with a great congregation of Gulls that were following a whale about a mile out from the town of Monterey. During the last week of December and in January only individuals in dark plumage were observed. Whenever a storm was brewing they were sure to appear near land. The greatest number noted at one time was during thick weather on Dec. 29th, a dozen or more being seen off Point Pinos in the course of an hour. The old birds were extremely wary. Even the young would rarely decoy, in this respect differing widely from the Black-footed Albatrosses of August ('No. 1,' p. 215). One day I found a young Short-tailed Albatross with a company of Gulls on the water close to a Chinese fishing boat—all waiting for the fishermen to throw something overboard. As we drew near the large bird became uneasy, being quick to discern that he had been singled out from his lesser companions. Another

time one was lured within range by the familiar manœuvre of tossing a dead Gull into the air. When wounded in the wing and cut down to the water it screamed with rage and viciously bit the disabled member. On being approached it turned fiercely toward the boat and seemed eager to attack the occupants.

Fulmarus glacialis glupischa. PACIFIC FULMAR.—On the morning of January 2d, there was an 'oil slick' on the bay about thirty yards wide and two miles long, extending from Point Pinos northeastward. The bay was placid and this narrow strip of oily water appeared almost as distinct as a traveled road through a field. Congregated upon it were over a hundred dark Pacific Fulmars, a few light ones, and several Rodgers's Fulmars. They were scattered about in groups and seemed to be feeding on a slimy substance floating on the surface. With the exception of a few on wing none were seen away from the 'slick.' Several times during my sojourn, the bay became a rendezvous, and in each instance the dark phase far outnumbered the light, not more than one of the latter being seen to ten of the former.

The fearlessness of Fulmars is proverbial. On one occasion a Pacific Fulmar instead of becoming frightened

other series exhibits in a large measure the two styles, the posterior half of the lower parts belonging to the light and the anterior to the dark.

Fulmarus glacialis rodgersii. RODGERS'S FULMAR.—Typical exemplifications of this subspecies appeared to be rare, if not altogether wanting.

The light phase of *glupischa* in a series in the collection of the Academy shades into an extreme example of *rodgersii* from San Francisco Bay having the 'mantle' pure white.

Puffinus opisthomelas.* BLACK-VENTED SHEARWATER.—These Petrels were very wary, usually sheering off from the boat out of range. The outer birds of the larger companies were apt to pass nearer than others. Their flight was low, apparently never more than ten feet above the surface of the water. They alternately flapped their wings and sailed, the wing beats varying from five to ten. Wounded birds (most of the examples secured were winged) invariably showed fight when being taken into the boat, one biting my hand until it bled.

All the specimens obtained differ considerably from the type of *opisthomelas* (No. 16,991, ♂, U. S. Nat. Mus., Cape S. Lucas, L. Calif., J. Xantus). Pending further study, I defer comment.

Puffinus griseus. DARK-BODIED SHEARWATER.—A male (one of the three specimens taken in December and January) has the chin and throat for the space of an inch and five-eighths pure white, faintly mottled, chiefly posteriorly, with drab-gray. In a male obtained in June the

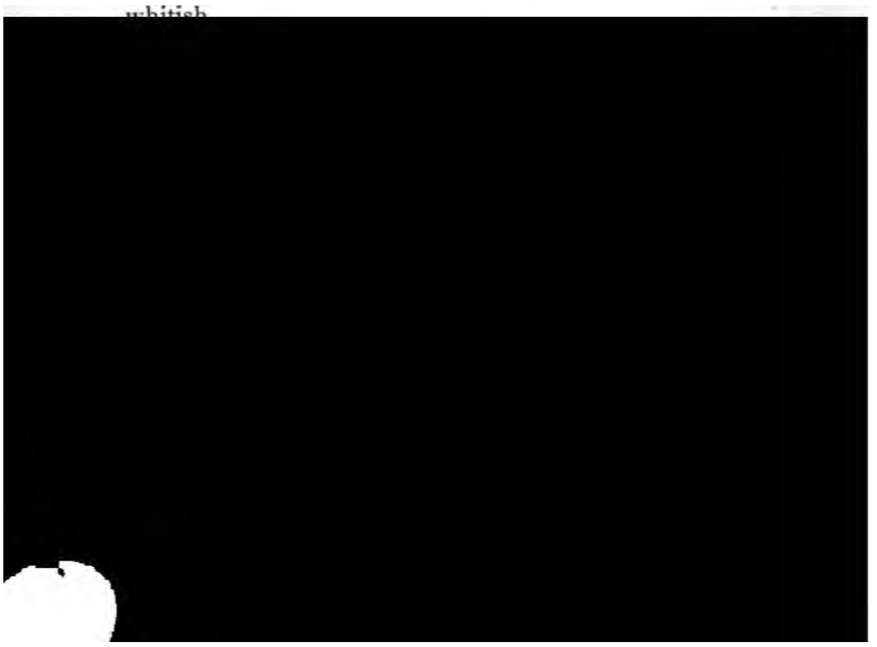
* According to Mr. Salvin ('Ibis,' 5th ser., vol. vi, pp. 356, 357), *Puffinus opisthomelas* should be restored as the name of the bird described by Dr. Cones from the Lower Californian coast, *Puffinus gavia* (Forst.) having "pure white under tail-coverts."

chin is largely pale cream-buff. Some summer specimens of both sexes have the chin whitish, and a few the throat also.

As pertinent to the matter in hand, I would announce the discovery by Mr. Joseph Mailliard of *Puffinus tenuirostris* off Monterey in December, 1895. Mr. Mailliard informs me he saw great numbers between the 14th and 20th of the month and secured twenty specimens, one of which he has generously presented to the Academy. These December Shearwaters in all probability were late voyagers on their way to the breeding habitat in the Southern Hemisphere.

The Academy is indebted to Mr. L. L. Edner of Pacific Grove for a skin of *Oceanodroma furcata* taken at Monterey, June 13, 1895, at which date tardy north-bound migrants of this species were said to be plentiful on the bay.

Phalacrocorax dilophus albociliatus. FARALLONE CORMORANT.—They were not abundant, being lost sight of among the Brandt's Cormorants. A February specimen in the collection is in transition plumage, having the jugulum and fore-breast conspicuously pied with black and whitish.



of paucity and abundance. Adults were easy to secure during a high wind; carrying so much sail, they were reluctant to seek safety in flight.

Merganser serrator. RED-BREASTED MERGANSER.—At the outset no drakes were seen, but later they began to make their appearance along the rocky shore, where the females were common. Both sexes were shy.

Aythya collaris. RING-NECKED DUCK.—A drake was captured by my boatman at the larger reservoir near Pacific Grove on the day of my coming.

Charitonetta albeola. BUFFLE-HEAD.—Females were quite common on the reservoir mentioned. Only one male was seen.

Oidemia deglandi. WHITE-WINGED SCOTER.—Although they were very common, there were days when none were met with. Unlike their near relatives, the Surf Scoters, they always gave the boat a wide berth, probably because they were esteemed an edible duck by the Portuguese fishermen.

Oidemia perspicillata. SURF SCOTER.—The great abundance of Surf Scoters and Loons gave an aspect to the ornis of the bay wholly wanting in summer. For ducks, these Scoters were tame, and it was without difficulty that a series was secured.

Erismatura rubida. RUDDY DUCK.—About twenty were on the reservoir with the Coots on the day of my visit. Like the other denizens of the place they would not leave it when harassed.

Ardea herodias. GREAT BLUE HERON.—Two were seen on the stranded kelp, one in the cove near the Laboratory and the other on the ocean at Point Pinos. A third was noted at Seal Rocks.

Fulica americana. AMERICAN COOT.—Having learned that an army of 'Mud-hens' were making the larger reservoir back of Pacific Grove their winter quarters, I visited this little sheet of water on the day before Christmas, finding several hundred swimming upon the surface. Although they were pursued in three boats and thirty of them shot, they made no attempt to escape beyond flying from one side of the reservoir to the other. Because they stirred up the mud of the bottom, they had been relentlessly persecuted by the men employed by the water company. Some time before, their ranks had been thinned in a single afternoon to the number of three hundred, and afterwards, I was told, they were exterminated. At the mouth of the Carmel River a few were seen on the sand-bars, Jan. 9th.

NEW MALLOPHAGA, I,—WITH SPECIAL REFERENCE TO A COLLECTION MADE FROM MARITIME BIRDS OF THE BAY OF MONTEREY, CALIFORNIA.

(With Plates ii-xv.)

BY VERNON L. KELLOGG.

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THE MALLOPHAGA—INTRODUCTION.

The Mallophaga constitute a small order of parasitic insects which live externally on the bodies of birds and mammals. The insects are small, one-tenth of an inch being perhaps an average length, wingless, and have biting mouthparts, with which they feed on the feathers or hair of their host, not sucking blood as the true lice do. They have an incomplete metamorphosis. The structure and habits of the insects have until recent years been very

imperfectly understood—even yet the position of the group among insects is but provisionally established (see *postea*), and the knowledge of the life history is strangely incomplete.

In America, besides some account of the commoner forms infesting domestic birds and mammals included in Professor Herbert Osborn's "The Pediculi and Mallophaga affecting Man and the Lower Animals" (Bull. No. 7, 1891, Div. of Ent., U. S. Dept. Agric.), and a discussion by Prof. A. S. Packard (Proc. Amer. Phil. Soc., 1887, vol. xxiv) of the position of the group among insects, practically nothing touching the systematic consideration of the group has been published.

Historical and Bibliographical.

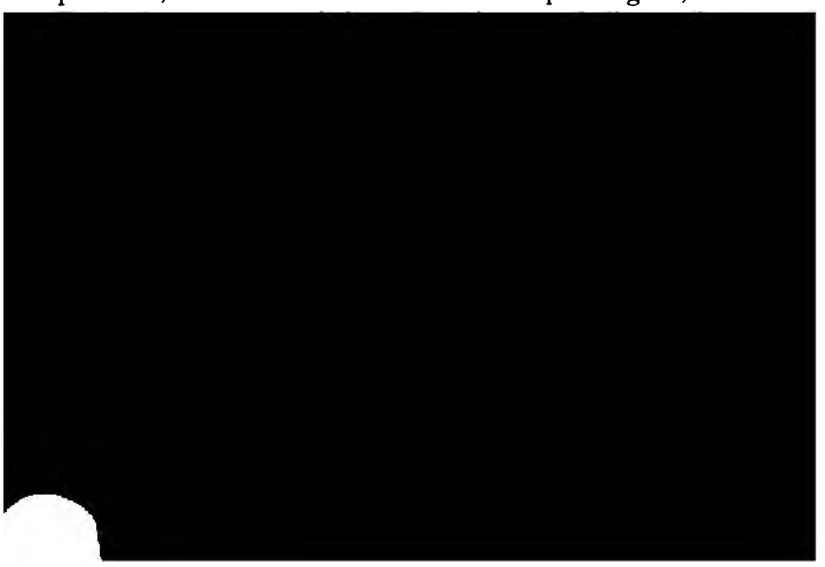
European.—The Mallophaga are first recognizably mentioned in the writings of Redi (1668 and 1686), where the common *Trinoton luridum* of the ducks may be recognized in his "louse of the teal," and the common *Lipeurus baculus* of the pigeons is evidently the subject of his description of "*Pulex columbæ majoris.*" In the various writings of Albin (1720), Otto Fabricius (1780), J. C. Fabricius (1781, 1787, 1805), De Geer

published in Germar's Magazin der Entomologie, vol. iii, 1818, Halle, presents the essential features of the classification of the group now used, and contains the earliest accepted nomenclature. Since the publication of this pioneer memoir four monographic works have been issued, together, needless to say, with numerous lesser memoirs containing descriptions of new species, compiled and more or less comprehensive conspecti of the group in text-books, and morphological treatises.

The monographs indispensable to the student of the Mallophaga are Henry Denny's Monographia Anoplurorum Britanniæ, or an Essay on the British Species of Parasitic Insects, 1842, London, illustrated with colored plates; Christoph Giebel's "Insecta Epizoa, die auf Säugethieren und Vögeln schmarotzenden Insekten, nach Chr. L. Nitzsch's Nachlass bearbeitet, mit XX Tafeln nach Nitzsch's Handzeichnungen," 1874, Leipzig; E. Piaget's "Les Pediculines, Essai Monographique, vol. i, Texte, vol. ii, Planches, 1880, Supplement, 1885," Leyden; and O. Taschenberg's "Die Mallophagen, mit besonderer Berücksichtigung der von Dr. Meyer gesammelten Arten," Nova Acta der Ksl. Leop.-Carol. Deutschen Akademie der Naturforscher, Band xliv, No. 1, 1882, Halle. Of these monographs Denny's is limited to a consideration of the parasites found on birds collected in England, his descriptions are too brief, and the colored figures too superficially drawn, so that it is often impossible to recognize from his description and illustration the species of parasite which he had under consideration. Giebel's monograph, as indicated in the title, is based on the unpublished descriptions and drawings of Nitzsch. Giebel also had access to the specimens collected and prepared by Nitzsch. The work is a monumental one, although many of the descriptions are incom-

plete, and the colored illustrations leave much to be desired in the way of accurate detail. Piaget's monographic essay is easily the most valuable treatise on the group, the descriptions being good, the uncolored figures in every way admirable, and the scope of the work truly monographic. Piaget has fairly attempted to include in his original essay a consideration of every species of Mallophaga described up to 1880. In his Supplement he publishes the descriptions of more than 100 new species which have come under his observation. Taschenberg's memoir is the first part of what he hopes to make a complete monograph of the group. It includes the genera *Goniodes*, *Goniocotes*, *Lipeurus*, *Ornithobius*, *Akidoproctus* and *Trichodectes*. The descriptions of new species are very complete, and the keys to species in the considered genera of great value; the illustrations only, though good, are not up to the exceptionally high standard of the work. Taschenberg, like Giebel, has had access to Nitzsch's types.

Of the lesser systematic memoirs Nitzsch's posthumous papers, edited by Giebel, in the Zeitschrift für gesammte Naturwissenschaft, vols. xvii, 1861, xviii, 1861, and xxviii, 1866, are the most important; all of their contents are, however, included in the Insecta Epizoa. Next in importance, as far as number of described species goes, are



Lipeurus jejunus (Zeitschr. f. wiss. Zool., 1869, vol. xix, p. 452), of Melnikoff on the embryology of the Mallophaga and of the Pediculidæ (Archiv f. Naturgesch., 1869, vol. xxxv, p. 136), and of Grosse on the anatomy of *Tetraopthalmus chilensis* [=*Menopon titan*] with some comparative studies (Zeitschr. f. wiss. Zool., 1885, vol. xlii, p. 530), are the most important. A full abstract of Grosse's paper was published by Macloşkie in the American Naturalist, 1886, vol. xx, p. 340, and is thus readily accessible to American students.

A few descriptions of new species have been published recently by Piaget (Tijdschr. v. Ent., and Notes of the Leyden Museum), and by Picaglia (Atti d. Soc. Ital. di Sci. Nat., and Atti d. Soc. dei Nat. di Modena).

I append a bibliographic list of the more important systematic and morphological memoirs. Full bibliographic lists are to be found in the monographs of Giebel and Piaget. A good list is that published by Picaglia at the beginning of his paper, "Pediculini dell'Istituto anatomo-zoologico della R. Università di Modena," Atti d. Soc. dei Naturalisti di Modena, 1885, serie 3, vol. iv.

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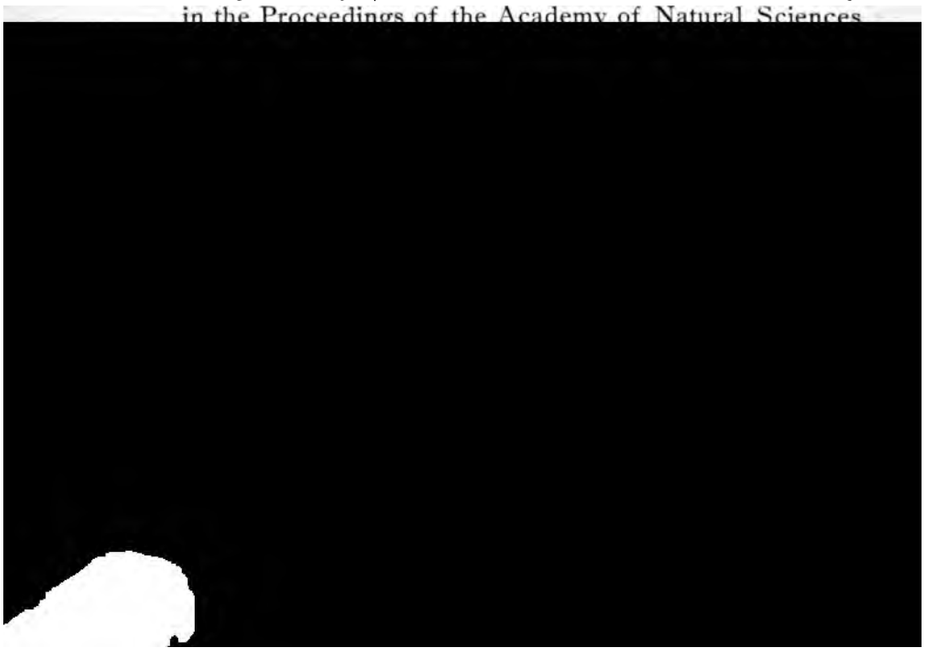
AMERICAN. As already mentioned in the Introduction, there are practically no American systematic papers on the Mallophaga excepting Professor Herbert Osborn's account of "The Pediculi and Mallophaga affecting man and the lower animals" (Bulletin 7, 1891, Division of Entomology, U. S. Dept. Ag.) Of this bulletin pages 30–54 treat of Mallophaga found on domestic mammals and birds, including the cat, dog, bear (sic), llama, goat, sheep, horse, mule, cow, guinea-pig, pouched gopher (sic), duck, goose, swan, chicken, pigeon, peacock, pheasant, guinea-fowl and turkey. Many of the species

referred to in the bulletin have evidently been observed on animals in America by Professor Osborn, but just how many and what species are not told. One new species, *Trichodectes geomydis*, found abundantly on the Pocket Gopher, is described and figured. I find this species common on *Thomomys talpoides bulbivorous* in this State (California). Among the illustrations of the bulletin are twelve original ones, indicating that at least these twelve species have been personally observed by Professor Osborn.

In the American Monthly Microscopical Journal for November, 1894, Professor Osborn publishes a key to the genera, including in it all of the genera then known, excepting Westwood's *Ancistrona* and Taschenberg's *Eurymetopus* and *Bothoriometopus*.

In the American Naturalist, 1871, in a paper entitled "Certain Parasitic Insects," Professor A. S. Packard names, illustrates, and briefly describes seven new species of Mallophaga collected from American birds. Unfortunately neither the descriptions nor illustrations have been sufficient to enable any one of these species to be recognized by subsequent writers. Similarly Dr. Leidy in the Proceedings of the Academy of Natural Sciences



these types wherever they are found." Dr. Burnett noted that "although there are single species (of parasites) peculiar to particular animals, there are others which are found on different species of the same genus as is the case in the parasites living on birds of the genus *Larus* (Gulls) and the diurnal birds of prey." From an examination of the structure of these animals, Dr. Burnett was of opinion that they should be placed in an order by themselves, closely allied to the Insecta; "they number about 250 species, the mandibulate parasites occupying the highest and the haustellate the lowest position in the order." In the second paper Dr. Burnett makes a curious argument for the theory of a special creation of each species of animal based on the facts shown in his study of the distribution of their parasites.

Prof. A. S. Packard read at the meeting of the American Philosophical Society, September 2, 1877, a paper "On the Systematic Position of the Mallophaga," which was published in the Proceedings of the Society, 1887, vol. xxiv, p. 264. Prof. Herbert Osborn has published in Insect Life, 1890, vol. iii, p. 115, a "Note on the Period of Development in Mallophaga," and in the same journal, 1891, vol. iv, p. 187, a paper on the "Origin and Development of the Parasitic Habit in Mallophaga and Pediculidæ."

I append a list of the American papers.

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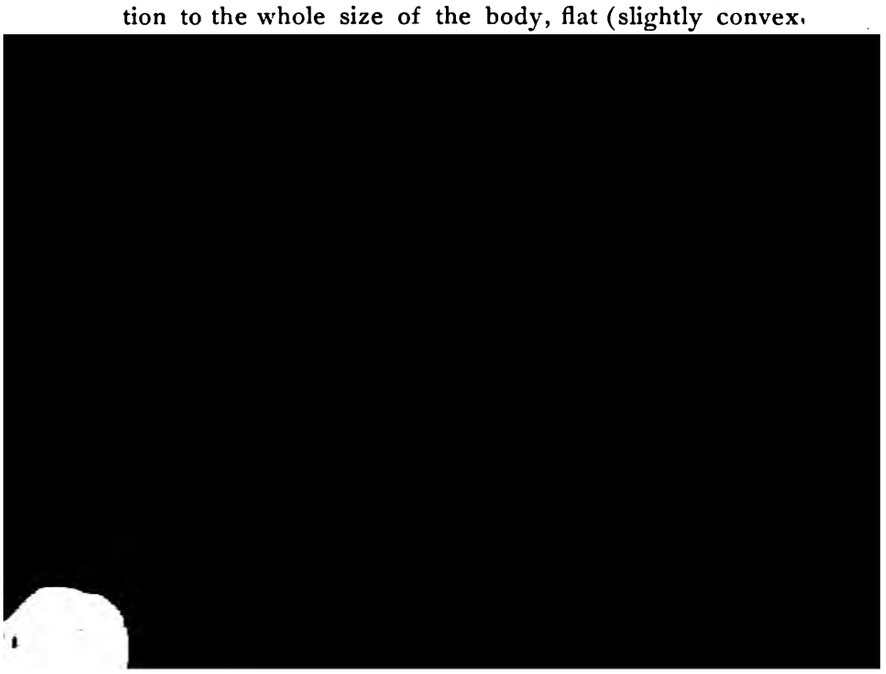
STRUCTURE.

EXTERNAL.—The characteristic external appearance of the Mallophaga is due to a structural condition incident to the parasitic habits of the insects. The body is small, wingless, greatly flattened and usually strongly chitinized. There are no indications of wings in any stage of the insect's life.

Head (fig. 7, plate ii). The head is large in proportion to the whole size of the body, flat (slightly convex,



ored plate, whose anterior margin, variously notched, roundly emarginated, truncated or convex, forms the frontal line of the head. The suture separating the clypeus from the epicranium is usually distinct or unmistakably indicated, sometimes indistinguishable. The hind-head is usually widest across the temporal region, the temples often being strongly expanded laterally with angulated or rounded margin. The occipital region is usually concave, so that the head sits "hat-like" on the prothorax. The head presents certain chitinous bands projecting forward from the occipital margin, inwardly from the eyes, forward from the bases of the antennæ, etc. The presence or absence and the character of these bands are used as distinguishing specific characters, and the bands are named and defined in the Terminology (see *postea*).

The antennæ (figs. 10, 11 and 12, plate ii) are short, 3-, or 4-, or 5-segmented and vary much in shape and character. They are filiform (suborder Ischnocera) or clavate or capitate (suborder Amblycera), and sometimes differ in the two sexes of the same species. When this is the case they are the antennæ of the male which depart from the typical condition, showing appendages on one or more segments, probably used for grasping the female. The antennæ arise from or near the lateral margins of the head, and usually from about the middle of the margin. The fossa may be deep or shallow; its angles projecting and acute or short and rounding; and the antennæ may project directly and always from the head (suborder Ischnocera) or they may lie concealed in excavations on the under side of the head (suborder Amblycera).

The eyes are simple and are located in the lateral margins of the hind-head not far behind the antennary fossæ, in a deep or shallow ocular emargination of the lateral

margin, or on the non-emarginated margin. They are two in number, although each is sometimes slightly or almost completely divided by an angular emargination. They are flatly convex to hemispherical, and clear to strongly colored.

The mouth parts (figs. 7, 8, 9, plate ii), situated on the under side of the head, and variously from the middle of this aspect to the frontal margin, are fitted for biting and consist of rather large, strongly chitinized, usually two-toothed, usually sharply pointed mandibles, inconspicuous and as yet imperfectly known maxillæ without *palpi, and a labium of various character and size; either large and with 4-segmented palpi (family Liotheidæ) or small and without palpi (family Philopteridæ). Despite the good work of Grosse the knowledge of the mouth parts of the Mallophaga is still manifestly incomplete.

Thorax. The thorax, which is composed usually of but two segments (three in but three genera), the meso- and metathorax being indistinguishably coalesced, is flat, larger than broad, and variously shorter than the head to much longer than the head (in one species as long as the abdomen). The lateral borders of both sclerites are strongly chitinized. The metathorax sometimes closely

project upwards, being undoubtedly tactile organs. In the case of the three genera in which the mesothorax can be distinguished from the metathorax, this separation is especially evident in immature specimens, as would be expected in the case of a specialization by reduction.

The legs (fig. 13, plate ii) are strong and of variable length; the forelegs are the shortest and are used as foot-jaws for carrying food to the mouth. When at rest the forelegs project forward beneath the head. The coxæ are usually short (long and projecting beyond the lateral margins of the thorax in one genus) and are rarely appendaged. The femora vary from long, subcylindrical, to short, thick, subovoid; the tibiæ are usually shorter than the femora (sometimes as long, rarely longer) and slender, and are armed at the distal extremity with spines and sometimes, in the males, with special structures for holding the female. Both femora and tibiæ bear from a few to many short to long hairs; sometimes series of short, strong spines. The tarsi are 2-segmented, the distal segment with one (mammal-infesting forms) or two (bird-infesting forms) claws, the first segment of the tarsus is short and with or without one or two small lobes; the second segment is short (family Philopteridæ) or elongate and slender (family Liotheidæ) and bears a pulvillus between the claws.

Abdomen. The abdomen is flat, short, oval to long and slender, often differs in the sexes, especially in the shape and character of the posterior margin of the last segment, and is composed of 9 (sometimes apparently 8) or 10 segments. It may be almost naked or pretty thoroughly clothed with hairs, and bears almost always one to several short to long hairs in the posterior lateral angles of each segment, which angles sometimes project acutely. The hairs on the dorsal surface, as on the

thorax, sometimes arise from small, circular, uncolored spaces, when they are said to be "pustulated." The last segment is variously elongate, short, with emarginate, truncate or convex posterior margin, which is evenly or unevenly fringed with short to long hairs. The lateral margins of thesegments are usually strongly chitinized, the chitin being sometimes translucent, but usually dark brown to black.

INTERNAL.—For our present knowledge of the internal anatomy of the Mallophaga we are indebted chiefly to Nitzsch, Kramer and Grosse. Among the points of special interest presented by the internal structure are the concentration of the nervous system and the differing types of crop in the two sub-orders.

Alimentary Canal (figs. 1 and 2, plate ii). The œsophagus of the Amblycera simply expands widely to form a crop; in the Ischnocera the crop appears as a conspicuous diverticulum or lateral sac of the œsophagus. The crop often bears spines or teeth on its inner wall. There are two pairs of salivary glands, variously cylindric, clavate, sub-spheroid, reniform, or divided into many small cylindrical tubes. The stomach usually presents two forward-projecting sac-like expansions. There are

jejunus to be a long delicate tube with expanded, turnip-like, posterior extremity. The "wing-muscles" are greatly reduced. There are but four openings for the ingress of the blood, which is not rich in white corpuscles. Wedl was able to study the heart of *Menopon pallidum*, but Grosse could not succeed in making preparations showing the heart of *Tetraopthalmus chilensis* [=*Menopon titan*].

Respiratory System (fig. 6, plate ii). In *Menopon titan* I have found six pairs of abdominal spiracles (segments 3–8) and a pair of prothoracic spiracles. There are two large longitudinal trunks and one large transversal trunk (segment 4 of the abdomen) in *titan*.

Nervous System (fig. 3, plate ii). There are two head ganglia, the supra-œsophageal and the infra-œsophageal, and three thoracic ganglia lying close together. There are no abdominal ganglia, the hindmost thoracic ganglion sending back into the abdomen two large nerves, whose branches provide the abdominal viscera with nerves.

Life-History and Habits.

The Mallophaga have an incomplete metamorphosis. The eggs are elongate-oval, are fastened singly by some gluey substance to the vanes or barbs of the feathers, and the young issue by breaking off a circular cap or lid at the larger free end of the egg. The duration of the egg stage has not been determined for any species. A number of eggs of *Nitzschia pulicare* (host, the Chimney Swift, *Chætura pelasgia*), collected by P. H. Rolfs (Ames, Iowa), and kept, some of them, "in a tight pasteboard box in his vest-pocket, the others enclosed in cotton-plugged tubes under a setting hen," incubated under these circumstances in from 13 to 20 days. The age of the eggs at time of collecting was not known. The young

resemble the parents in essential characters; the noticeable differences are the comparatively larger head, the smaller, especially shorter, abdomen, and the absence or incompleteness of the markings, especially those of the abdomen. The color of the very young is always whitish; as they grow older chitinization follows and the brown and black colors appear (see plates). The number of moults or the duration of immaturity is not known for any species. I have observed nymphs (presumably in the stage preceding the final moult) which were fully as large as the adults of the same species. I have figured the immature stages for one or more species in nearly all the genera met with by me on the water and shore birds (see plates). In none of the monographic works is there any attention paid to the young. From the preceding brief account it is obvious that the life-history of the Mallophaga is as yet practically unknown.

Parasitism. The parasitic habits of the Mallophaga have been the subject of some little study, mainly directed to ascertaining whether or not the blood of the host ever forms a part of the food of the parasite. From the condition of the mouth parts and from repeated examination of the contents of the crop the food of the Mallophaga is

tion, it would be wanting. A few instances are recorded of the presence of blood in the crop, but it has been suggested, with much show of probability, that the blood was such as might not infrequently, because of wounds, be found by the parasite on the feathers, perhaps dried and hard. There is one instance, however, known to me among the habits of the parasites which cannot be so readily explained. *Menopon titan* var. *linearis* of the California Brown Pelican *(Pelecanus californicus)* is found commonly clinging to the inner surface of the gular pouch. The clinging is accomplished by the use of the mandibles, each parasite of the half dozen individuals which may be grouped together having its mandibles inserted in the skin of the pouch. The mandibles are not thrust in suddenly on touching the insect with the collecting forceps, but the insects are always, as far as observed, firmly lodged. Indeed some effective clinging would be necessary always to prevent the carrying away of the parasites by the water taken into the pouch of the pelican in feeding. In several instances a small region surrounding the parasites was raw and bloody. What is it that serves these parasites for food? Perhaps, of course, simply the epidermal scales of the inner wall of the pouch.

The abundance of certain species of Mallophaga, like *Menopon pallidum*, on domestic poultry causes the hosts much inconvenience and sometimes actual injury. The injury is done by the irritation of the skin of the host by the sharp-clawed feet of the hordes of parasites, rather than by any direct hurt through the feeding. After the death of the host, the parasites either attempt to leave the body, usually migrating slowly toward the head, or simply die on the body. The death of the parasites remaining on the body usually ensues in two or three days. I have observed the death of some in four or five hours,

and, on the other hand, have collected live parasites from a bird skin seven days old. The death of the parasites can hardly be caused by starvation, in view of their feeding habits, but rather must be attributed to the lack of animal heat which they have been accustomed to during the life of the host.

Mallophaga which infest swimming and diving birds are not furnished with special contrivances for their pseudo-aquatic life. They, in fact, never come, necessarily, into contact with the water, living, as they do, at the roots of the feathers where the water can never penetrate, and where they have a constant and sufficient supply of air for the longest submergence possible to the host.

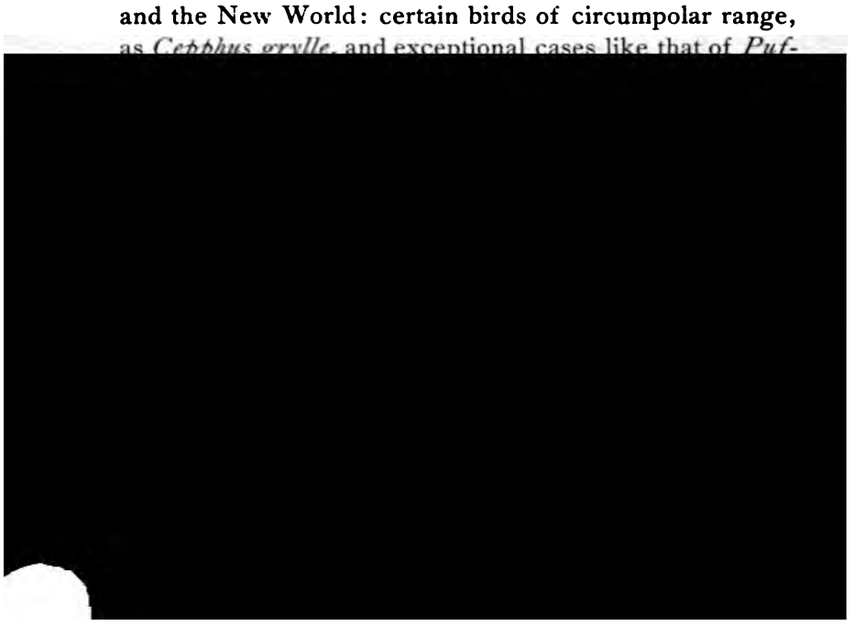
The origin of the parasitic habit among the Mallophaga and its influence on their structure are questions of much interest, but ones which cannot be touched on here.

Some of the phenomena of the relations of parasites to hosts, the migration of the parasites, and the influence of their peculiar habits on the rapid establishing of variations, are considered in the following paragraphs under the head of "Distribution."

may be readily accomplished: (a) from male to female, or *vice versa*, during copulation; (b) from parent to young, during the nesting season. In both of these cases there is actual contact of the hosts. If at other times in the life of the host it comes into actual contact with other birds of its own species migration of parasites can take place. Such cases must occur among birds of gregarious habits; the crowding together of gulls on small masses of floating sea-weed, or on masses of food, or on the rocks of the shore, must bring about actual contact of the bodies of the birds. But, as common observation shows, there are in the crowding groups of gulls individuals of different species. Thus in these cases there is possible a migration of parasites from one bird-species to another, these species in the case of the gulls being closely related ones—species belonging, in fact, to one genus. But on the "roosts" of maritime birds, the cliffs of the shore and the outlying rocks, birds of very different kinds sit huddled together. Along the rocky shores of Point Pinos on the Bay of Monterey, pelicans, cormorants and gulls gather in great numbers and perch side by side on favorite "roosts." It seems as if migration of parasites from one to another of these bird-species could here, and elsewhere under similar conditions, often be accomplished; and I have found *Lipeurus toxoceras*, described by Nitzsch from a cormorant, on both a cormorant and a pelican shot on this shore. Other cases of contact occur between birds of prey and their victims (I have noted a *Physostomum*, a genus confined normally to passerine birds, on a sparrow-hawk); and in those few groups of closely allied forms among which hydridization occurs, as with the ducks. Still other opportunities for accidental or normal contact between birds of different species will suggest themselves to the student.

The opportunities for migration so far referred to are sufficient to account for the spreading of a parasite species among individuals of its host species, and for the condition presented in cases like those of *Docophorus lari* and *Nirmus lineolatus* common to many species of gulls, and those of *Trinoton luridum* and *Docophorus icterodes* common to many species of ducks: cases where the birds are of gregarious habits, or where hybridization occurs.

But of those cases of a parasite common to two or more bird-species, one or more of which are Old World forms and the other or others New World forms, a further explanation is necessary. In this paper I ascribe to Mallophagous species described from specimens taken on birds of Europe or elsewhere not on the American continent specimens of twenty-two different species of Mallophaga taken on American birds. Examples of such occurrence are *Nirmus signatus* and *N. pileus* from the American Avocet *(Recurvirostra americana)* and described by Piaget and Nitzsch from specimens taken on the European Avocet *(Recurvirostra avocetta); Docophorus pertusus* from *Fulica americana* (America), originally described from *Fulica atra* (Europe), and so on. In rare instances we find a bird-species common to both the Old World and the New World: certain birds of circumpolar range, as *Cepphus grylle*, and exceptional cases like that of *Puf-*



species of Mallophaga referred to in this paper as being taken on American birds one-third are referable to species previously described from European or Asiatic birds), must have another explanation than any yet suggested. This explanation, I believe, is, for many of the instances, that the parasitic species has persisted unchanged from the common ancestor of the two or more now distinct but closely allied bird-species. With the spreading of the ancestral bird-species, geographical races have arisen within the limits of the species which have, with time and isolation caused by newly appearing geographical barriers (due to geologic or climatic changes), come to be distinct species—species often distinguished only by superficial differences in color, etc. The parasites have remained practically unaffected by the conditions which have produced the differences among the birds; the temperature of the host's body, the feathers *as food*, all of the environment is essentially unchanged in its relation to the parasite. The parasitic species thus remains unchanged, while the first *Larus* species or *Anas* species becomes differentiated into a dozen or score of specific forms, all with a common parasite.

In substantiation of this explanation of a common possession of a parasitic species by Old and New World birds some examples may be referred to. As already mentioned, I have found on *Fulica americana* the same species of parasite, *Docophorus pertusus*, described by Nitzsch from specimens taken from the European *Fulica atra; Docophorus melanocephalus* taken by me on *Sterna maxima* is recorded by European authors from *Sterna caspia* and *S. cantiaca; Nirmus punctatus*, found by me on *Larus occidentalis* was described by Nitzsch from *Larus ridibundus* and has been found by Piaget on *Larus dominicans* from Chile and on *Larus ichthyætus* from the

Volgas; *Nirmus signatus* and *N. pileus* found by me on *Recurvirostra americana* were described by Piaget and Nitzsch respectively from *Recurvirostra avocetta*, the European Avocet; *Lipeurus ferox* taken by me on *Diomedea albatrus* is recorded by European writers from *Diomedea exulans*, *brachyura* and *melanophrys; Lipeurus forficulatus* taken by me on *Pelecanus erythrorhynchus* and *P. californicus* was described by Nitzsch from *P. onocrotalus;* and similarly the most of the twenty-two previously described species taken by me from American birds might be thus offered as examples. We have in all of these cases the common parasite occurring on the American representatives of the genus to which the original Old World host belongs. Looking now for the exceptions to this condition—namely, for instances where the known species when found on an American bird is found on one widely separated phyletically from the European host—we find no clearly defined instance of this condition, no instance where association during life or "straggling" after death of the host can be put aside as possible explanations of the presence of the parasite on the unexpected host.

crossing among less closely related individuals. For example the individuals of a parasite species on a bird of long life and non-gregarious and monogamous habits, like an eagle, live very much the life of an isolated community. There must be many years of in-and-in breeding. It is like island life. The result is certain: the members of this isolated group will soon differ from the specific type in noticeable particulars. On the other hand, the conditions of life on this "island" are practically identical with the conditions on other similar "islands"—other eagles—inhabited by other individuals of the same parasite species, so there is no iufluence working to produce a wide divergence of the members of these various isolated groups of individuals of the same species. Now this isolation of groups of individuals is in some degree an incident of the life of all Mallophaga; in some instances it is considerable; in others, inconsiderable, but taken altogether a condition in the life of the whole order exerting an influence which has the readily recognizable result of creating a great number of small variations within species limits.

We have noted now two influences resulting from the peculiar habits of the Mallophaga which are somewhat opposed to each other. One influence, due to the uniform (as far as relation to parasite goes) conditions of the habitat, the body of the host, tending to preserve essentially unchanged the type-forms of the parasites; the other influence, due to the isolation of groups of individuals and the consequent close breeding, tending to foster and fix small variations. The results, manifest to any student of the group, are to render difficult the division of the order into distinct genera on account of the general similarity of structure, and to make difficult the definition of species on account of the many slight variations among

the individuals from different bird individuals. While I believe myself able to refer specimens taken from American birds to a score of species described from specimens taken from European and Asiatic birds, in all of these instances there are slight but recognizable differences between the American specimens and the type-forms of the species (as well as I am able to make comparison, having only the drawings and descriptions of these type-forms to refer to).

The differences in relative abundance or rarity of the individuals of a species, and in the relative freedom or seriously infested condition of the hosts may be referred to briefly. Certain specific examples will serve to illustrate the various conditions. In the first place the host species may have several parasitic species as *Diomedea albatrus*, *Fulmarus glacialis* vars. *glupischa* and *rodgersii* and *Fulica americana*, each with six species of parasites; or the host species may have but one (very rarely) or two or three parasitic species infesting it, as with most of the ducks and gulls. A parasitic species may be constant in its appearance on the individuals of its host species, as *Docophorus lari*, almost certain to be found on any gull specimen shot, *Lipeurus celer*, which I found on twenty-

from a single bird, and which is always abundantly present on its host; or the individuals may be few even though the parasite is a constant one, *i. e.*, almost always to be found on any specimen of the host examined. *Trinoton luridum* of the ducks is a good example of this constant presence in small numbers. There may be more than one species of the same genus of parasites on a single host, as *Lipeurus celer* and *Lipeurus varius*, both numerous on the Fulmars; but usually the different parasites of a host represent different genera, exemplified by the remaining four species of parasites of the Fulmars which belong to four other and different genera.

Finally, I may append to these desultory remarks concerning the distribution of the Mallophaga and the influence on their taxonomy of their peculiar habits of life a list of those bird hosts with their parasites, the examination of which has afforded the data for this paper. In preparing the list I have eliminated all instances of undoubted "straggling."

LIST OF HOSTS WITH PARASITES.

Colymbus nigricollis californicus.
  Docophorus lari.
  kansensis.
  Menopon tridens var. insolens.
Urinator pacificus.
  Docophorus colymbinus.
  graviceps.
  Oncophorus advena.
  Menopon tridens var. pacificum.
Urinator lumme.
  Docophorus colymbinus.
  lari.
  graviceps.
  Nirmus farallonii.
Ceratorhina monocerata.
  Docophorus acutipectus.
Ptychorhampus aleuticus.
  Docophorus montereyi.
  Menopon loomisii.
Synthliborhampus antiquus.
  Docophorus montereyi.
  atricolor.
  Menopon loomisii.
Brachyrhampus marmoratus.
  Docophorus montereyi.
  atricolor.
Uria troile californica.
  Docophorus calvus.
Rissa tridactyla pollicaris.
  Docophorus lari.
Larus glaucus.
  Docophorus lari.
Larus glaucescens.
  Docophorus lari.
  Nirmus lineolatus.
  Colpocephalum funebre.
  Menopon infrequens.

Larus occidentalis,
Docophorus lari.
Nirmus lineolatus.
punctatus.
Larus argentatus smithsonianus.
Docophorus lari.
Nirmus lineolatus.
Larus vegæ.
Docophorus lari.
Nirmus lineolatus.
Larus californicus.
Nirmus lineolatus.
Larus delewarensis.
Docophorus lari.
Nirmus lineolatus.
punctatus.
Larus brachyrhynchus.
Docophorus lari.
Nirmus lineolatus.
Larus canus.
Docophorus lari.
Nirmus lineolatus.
Larus heermanni.
Docophorus lari.
Nirmus lineolatus.
felix.
Sterna maxima.
Docophorus melanocephalus.
Nirmus præstans.

Fulmarus glacialis glupischa.
Docophorus occidentalis.
Lipeurus celer.
varius.
Eurymetopus taurus.
Ancistrona gigas.
Menopon numerosum.
Fulmarus glacialis rodgersii.
Docophorus occidentalis.
Lipeurus celer.
varius.
Eurymetopus taurus.
Ancistrona gigas.
Menopon numerosum.
Puffinus opisthomelas.
Lipeurus diversus.
limitatus.
testaceous.
Giebelia mirabilis.
Puffinus griseus.
Lipeurus diversus.
limitatus.
Giebelia mirabilis.
Phalacrocorax dilophus albociliatus.
Docophorus lari.
Nirmus farallonii.
Lipeurus toxoceras.
Phalacrocorax penicillatus.
Nirmus farallonii.

Merganser serrator.
Docophorus icterodes.
Lipeurus temporalis.
squalidus.
Merganser americanus.
Lipeurus squalidus.
Trinoton luridum.
lituratum.
Anas boscas.
Docophorus icterodes.
Trinoton luridum.
lituratum.
Anas americana.
Trinoton luridum.
Anas carolinensis.
Trinoton luridum.
Spatula clypeata.
Trinoton luridum.
Dafila acuta.
Docophorus icterodes.
Trinoton luridum.
lituratum (?)
Aythya americana.
Docophorus icterodes.
Aythya affinis.
Docophorus icterodes.
Charitonetta albeola.
Lipeurus squalidus.
Oidemia deglandi.
Docophorus icterodes.
Oidemia perspicillata.
Docophorus icterodes.
Lipeurus constrictus.
Erismatura rubida.
Docophorus icterodes.
pertusus.
Trinoton luridum.
Ardea egretta.
Colpocephalum laticeps.
Fulica americana.
Docophorus pertusus.
Lipeurus picturatus.
longipilus.
Oncophorus advena.
Laemobothrium atrum.
Menopon tridens var. pacificum.
Recurvirostra americana.
Nirmus signatus.
pileus.
Colpocephalum uniforme.
Menopon indistinctum.
Charadrius squatarola.
Docophorus fuliginosus.
Charadrius dominicus.
Nirmus orarius.
Colpocephalum timidum.

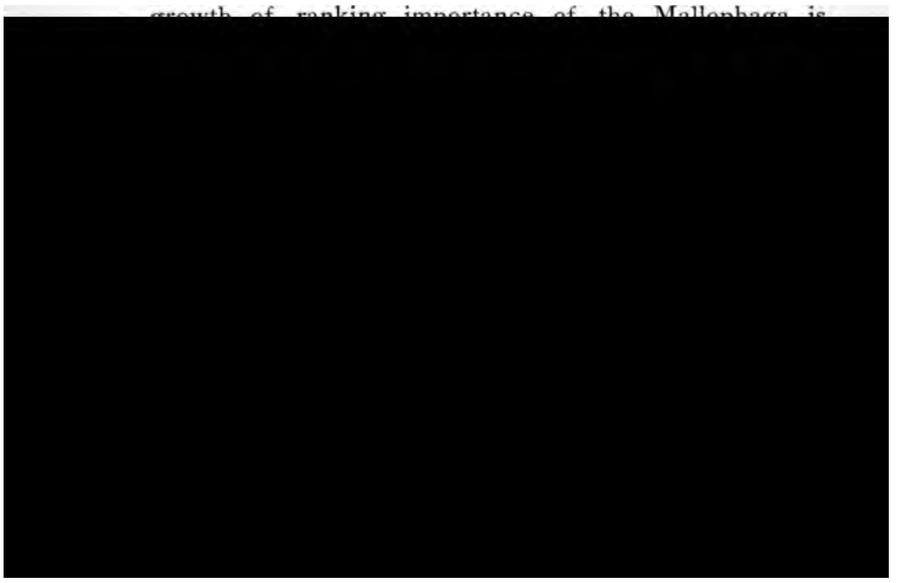
Position among Insects.

What the position of the Mallophaga among insects is, is still a moot question, as indeed, strictly speaking, is the position of any one of the groups. The Mallophaga by reason of their habits have been constantly associated in entomological literature with the Pediculidæ. It is hardly worth while here to trace the Mallophaga in their tortuous path through the various schemes of insect classification from the times of Redi to the present day. It has not been until comparatively recent years that the facts of structure and life history upon which the classification of any group depends were known in the case of the Mallo-

phaga. The classificatory attempts prior to that time were simply the results of conjecture.

Grouped for a long time with the Hemiptera, because the Mallophaga are, what the Pediculidæ, undoubted Hemiptera, are, external parasites of animals, the testimony of the biting mouthparts finally effected their removal to that heterogeneous group of insects, the order Pseudo-Neuroptera. Here they came to be associated, in all of these steps more and more nearly approximating the truth, with the Termites, Psocids, Perlids and Embids, these groups forming the suborder Platyptera. Dr. Brauer in 1885 broke up the order Pseudo-Neuroptera, and after this cataclysm our Mallophaga found themselves in company with the Termites and Psocids constituting the order Corrodentia. Finally under the impetus thus acquired in order-breaking many entomologists have gone further, and in the hands of these men the Mallophaga reach the standing of an independent order. The latest American text-book of entomology, Comstock's Manual of Insects, 1895, adopts this treatment of the group.

Whether a group of insects should be called an order or a suborder or what not is largely, of course, a matter of an author's attitude in matters classificatory. The point manifest in all this shifting about and gradual growth of ranking importance of the Mallophaga is



ized, of a racial condition, but of a specialization, albeit in the line of reduction or degradation. With the simple general structure there goes a highly concentrated nervous system, greatly modified mouth parts, and curiously specialized antennæ.

The thorough study of the life-history, embryonic and postembryonic, is needed to throw more light on the position of the Mallophaga. Till such study is made, the present isolated position assigned the group, based on the known structure of the adult and on its habits, may be accepted as representing the consensus of authority.

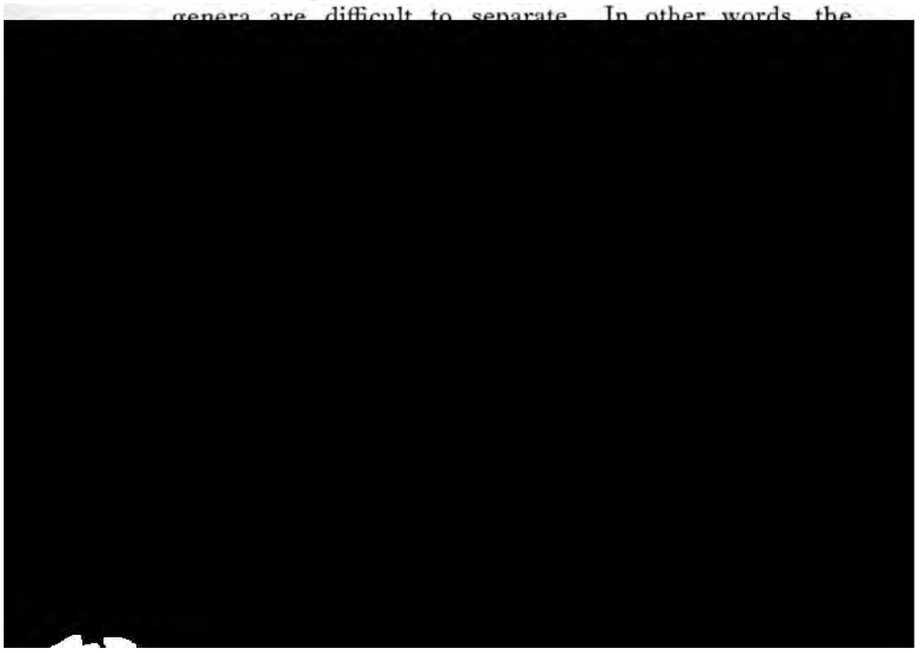
Classification.

The Mallophaga were divided by Nitzsch into two families, the Philopteridæ, with filiform antennæ and without maxillary palpi, and the Liotheidæ, with capitate 4-segmented antennæ and maxillary palpi. The family Philopteridæ included two genera, *Trichodectes*, with 3-segmented antennæ and 1-clawed tarsi, and *Philopterus*, with 5-segmented antennæ and 2-clawed tarsi. The latter genus was subdivided into the five subgenera, *Docophorus*, *Nirmus*, *Goniocotes*, *Goniodes*, *Lipeurus*. The family *Liotheidæ* similarly included two genera, *Gyropus*, with 1-clawed tarsi, and *Liotheum*, with 2-clawed tarsi. The latter genus was subdivided into six subgenera, *Eureum*, *Læmobothrium*, *Physostomum*, *Trinoton*, *Colpocephalum* and *Menopon*. The two 1-clawed genera *Trichodectes* and *Gyropus* were found by Nitzsch exclusively upon mammals; all the other genera exclusively upon birds.

In essential identity the classification of to-day is that of Nitzsch; it differs in discarding the generic groups *Philopterus* and *Liotheum*, and in considering the Nitzschian subgenera as genera, and in the addition of several new genera.

That change by which the one-time subgenera of *Philopterus* are now put on equality with the genus *Trichodectes*, and similarly the subgenera of *Liotheum* on equality with *Gyropus*, seems to me ill-advised. The two genera found on mammals differ so radically and in so many ways from their related genera in each family that I believe their striking host and structural differences should be emphasized in the classification. I propose, therefore, in the light of the present position of the Mallophaga as an independent order of insects, to rank the Nitzschian families as suborders, and the Nitzschian genera as families, and the Nitzschian subgenera, the genera of present day writers, as genera. This will leave unchanged the present generic names and ranking, but will restore the expression, first indicated by Nitzsch in his generic rankings, of differences between the mammalian parasites and the avian parasites. This re-ranking, which is practically a return to classification of Nitzsch, finds expression in the keys and synopses which I have arranged to receive all of the genera so far recognized.

Although the Mallophaga include already nearly 1000 described species there are but few genera and these genera are difficult to separate. In other words, the



not definitely answered by the key. In introducing into the key the genera which have been described since the making of the key used in the European monographs, I find naturally increasing difficulties; so I have accompanied the key with a synopsis of all of the described genera, calling attention to the characters which go to give any genus its peculiarly characteristic appearance. With the key and the diagnosis I hope that any genus can be satisfactorily determined. For definitions of the terms used in referring to various structures of the Mallophaga, see the Terminology, following the synopsis.

KEY TO THE SUBORDERS.

A. With filiform 3- or 5-segmented antennæ, and no labial palpi. Suborder ISCHNOCERA.

AA. With clavate or capitate 4-segmented antennæ, and 4-segmented labial palpi. Suborder AMBLYCERA.

KEY TO THE GENERA OF THE SUBORDER ISCHNOCERA.

A. With 3-segmented antennæ; tarsi with 1 claw; infesting mammals (family Trichodectidæ). TRICHODECTES N.

AA. With 5-segmented antennæ; tarsi with 2 claws; infesting birds (family Philopteridæ).

B. Antennæ similar in both sexes.

C. Front deeply angularly notched. AKIDOPROCTUS P.

CC. Front convex, truncate, or rarely with a curving emargination, but never angularly notched.

D. Species broad and short, with large movable trabeculæ (at the anterior angle of antennary fossa).

E. Forehead with a broad transverse membranous flap projecting beyond lateral margins of the head in the male, barely projecting in female. GIEBELIA Kellogg.

EE. Without such membranous flap. DOCOPHORUS N.

DD. Species elongate, narrow; with very small or no trabeculæ. NIRMUS N.

BB. Antennæ differing in the two sexes.

C. Species wide, with body elongate-ovate to sub-orbicular.

D. Temporal margins rounded; last segment of abdomen roundly emarginated; antennæ of male without appendage, third segment very long. EURYMETOPUS Tasch.

DD. Temporal margins usually angulated; last segment of abdomen convex, rarely angularly emarginated with two points.

E. First segment of antenna of male large, sometimes with an appendage; third segment always with an appendage. GONIODES N.

EE. First segment of antenna of male enlarged, but always without appendage; third segment without appendage; last segment of abdomen always rounded behind. GONIOCOTES N.

CC. Species elongate, narrow, sides sub-parallel.

D. Third segment of antenna of male without an appendage. ORNITHOBIUS Denny.

DD. Third segment of antenna of male with an appendage.

E. Front deeply angularly notched. BOTHRIOMETOPUS Tasch.

EE. Front not angularly notched.

F. Antennæ and legs long; a semicircular oral fossa. LIPEURUS N.

FF. Antennæ and legs short; oral fossa narrow, elongate, extending as a furrow to the anterior margin of the head. ONCOPHORUS Rudow.

KEY TO THE GENERA OF THE SUBORDER AMBLYCERA.

A. Tarsi with 1 claw; infesting mammals (family Gyropidæ). GYROPUS N.

AA. Tarsi with 2 claws; infesting birds (except *Boopia?*) (Family Liotheidæ.)

B. Ocular emargination distinct, more or less deep.

C. Forehead rounded without lateral swelling; antennæ pro-

CC. Sides of the head sinuous; forehead without labial lobes.
D. Body very broad; metathorax shorter than prothorax.
EURUM N.
DD. Body elongate; prothorax shorter than metathorax.
E. Ocular emargination filled by a strong swelling; sternal markings forming a quadrilateral without median blotches. NITZSCHIA Denny.
EE. Ocular emargination without swelling, hardly apparent or entirely lacking; median blotches on sternum.
F. Very large; with two 2-pointed appendages on ventral aspect of hind-head; anterior coxæ with very long lobe-like appendages.
ANCISTRONA Westwood.
FF. Small or medium; without bi-partite appendages of hind-head. MENOPON N.

SYNOPSIS OF MALLOPHAGA.

Suborder ISCHNOCERA.

With the antennæ filiform, 3- to 5-segmented, sometimes differing in the sexes; no labial palpi.

Family TRICHODECTIDÆ.

Characters of the single genus.

Genus *Trichodectes*. Infesting mammals; tarsi with one claw; antennæ 3-segmented, in some species differing in the sexes; legs thickly beset with hairs; female with a pair of bent appendages on the sides or ventral surface of the eighth abdominal segment.

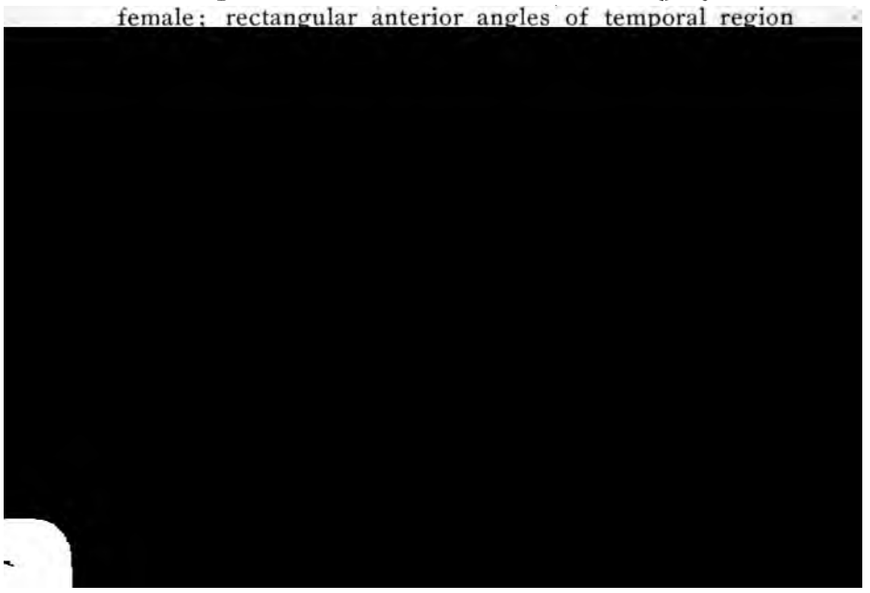
Family PHILOPTERIDÆ.

Infesting birds; tarsi with two claws; antennæ 5-segmented, not lying in an excavation on the under side of the head, but always projecting far beyond the sides of the head.

Genus *Docophorus* Nitzsch. (Plates iii and iv.) Body short and broad, head usually as wide across the temples as long, front broadly truncate or convex or slightly concave, rarely with a curving emargination; clypeus

with distinct suture, often with a broad uncolored anterior and lateral margin; signature usually shield-shaped, with acuminate posterior angle; prominent movable trabeculæ reaching to or beyond end of the first antennal segment; antennæ similar in the sexes, with thick first segment, segment 2 the largest, and segments 3–5 subequal. Thorax with meso- and meta-segments completely coalesced; legs rather flattened, insertions approached; front legs smallest and usually concealed beneath the head. Abdomen usually oval, of nine segments of about equal length; last segment of male rounded, of female small and emarginated. Color and markings whitish on buffy ground, markings clear light brown to opaque dark brown, and even to black; head with antennal occipital bands; thorax with lateral borders; abdomen with lateral bands, darkest, and lateral transverse blotches, longest in male where they nearly meet on the median line. This genus has been found on birds of all the larger groups except the Gallinæ.

Genus *Giebelia* Kellogg. (Plate xi.) General characters of *Docophorus;* forehead (labrum?) with a broad transparent membranous flap extending across the ventral surface of head and projecting conspicuously beyond lateral margins of head in the male and but slightly in the female; rectangular anterior angles of temporal region



Genus *Akidoproctus* Piaget. Body slender, elongate, Nirmoid in general shape; front of clypeus with a deep median rectangular notch, clypeal suture not distinct; antennæ similar in the sexes, situated distinctly before the middle of the head, short; prothorax rectangular, meso- and metathorax fused, widest (except in one species) in front; abdomen with broad sutures and a longitudinal median uncolored line; slightly mesad of the lateral band there runs parallel with it on each side a second narrow transparent lateral band; the two last segments in both sexes abruptly narrower than the seventh and conical. But four species belonging to this genus have been described.

Genus *Eurymetopus* Taschenberg. (Plate xi.) Body broad, *Docophorus*-like; antennæ differing in the sexes; clypeus broad, truncate; anterior angles of antennary fossæ produced and pointed; metathorax short, broad, without indication of constriction between meso- and meta-segments; coxæ not projecting beyond lateral margins of thorax; posterior segment of abdomen broadly round with slight rounding emargination, deeper in female than in male. But three species of this genus are yet known, of which one is so aberrant that it should probably be made the type of a new genus.

Genus *Goniodes* Nitzsch. Body large and broad; head usually with temporal margin and outer occipital margin angulated; head often varying in form in the sexes; antennæ differing in the sexes, third segment of male always with appendage, first segment enlarged and sometimes with appendage; prothorax usually trapeziform, metathorax much larger, rounded laterally; abdomen usually broadly oval, lateral band broad. Color usually whitish or pale yellowish, the blotches tawny, the bands dark brown to black. Found only on Gallinaceous birds.

Taschenberg has given sub-generic names to certain pretty distinctly separable groups of species. These sub-genera may be distinguished by the following table:

A. With rounded temporal and occipital corners. No appendage on third segment of male, or a very small one. *Stronglyocotes.*

AA. With angulated temporal and occipital corners.

B. Antenna of male with segments 4 and 5 very short, third segment with appendage. Temporal angles weak. *Coloceras.*

BB. Segments 4 and 5 of male antenna of ordinary size. Temporal angles distinct.

C. Segment 3 of male antenna with appendage; segment 1 long and thick and sometimes with appendage. *Goniodes s. str.*

CC. Segment 3 of male antenna without appendage (distal angle slightly produced); segment 1 without appendage. *Rhopaloceras.*

Genus *Goniocotes* Burmeister. General characters those of *Goniodes*, but usually smaller species, and with antennæ of male never appendaged; the antennæ differ but little in the sexes, the male sometimes having the first and second segments larger than in the female. The species of this genus are found on gallinaceous and columbine birds.

Genus *Ornithobius* Denny. Body elongate, narrow; head broad, rather quadrangular; clypeus with a frontal emargination expanded within so that the bounding sides

sides subparallel; head about as long as wide, with swelling rounded temples; clypeus including most of the forehead; without antennal bands, and with a deep angular frontal emargination or notch (much as in *Akidoproctus*); antennæ situated in front of middle of head and differing in the sexes; the antenna of male long, first segment thickened and as large as all the others together and with a pointed projecting process; antenna of female short, first two segments of equal length; legs very long, abdomen of both sexes with posterior segment 2-pointed behind. But one species has been described, taken from *Palamedea*.

Genus *Lipeurus* Nitzsch. (Plates vii, viii, ix and x.) Body long, slender; head usually narrow, elongate, with rounded temporal margins; clypeus usually with distinct signature, and with distinct or indistinct suture; antennæ differing in the sexes, the male antenna with first segment long and thick, rarely with appendage; third segment has an appendage, which is sometimes small and inconspicuous; the female antenna is simply filiform with first segment the thickest and second segment the longest; metathorax usually at least twice as long as the prothorax, often showing a lateral constriction indicating the line of fusion of meso- and meta-segments; the legs arise far apart, the proximity of the coxal cavities of the second and third pairs of legs to the thoracic margins being one of the diagnostic characters of the genus; the coxæ are long and project conspicuously beyond the lateral margins of the thorax; abdomen elongate and narrow, with segments 8 and 9 fused. Body color, white to brown, with conspicuous markings of pale brown to black. There are many described species and they have been found on all kinds of birds, being especially common on swimmers and rare on passerine birds.

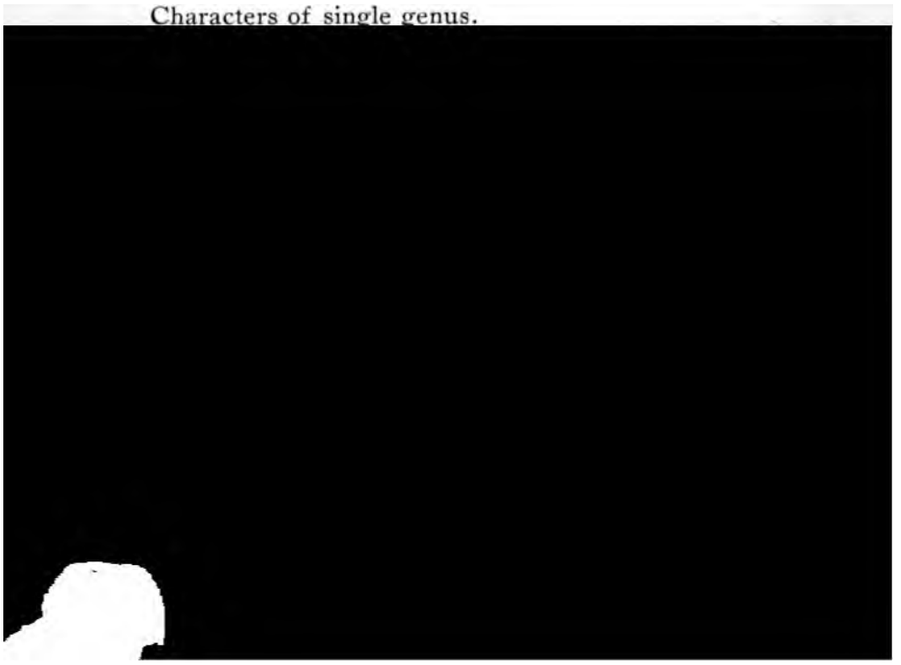
Genus *Oncophorus* Rudow. (Plate xi.) (The generic name *Oncophorus* was proposed by Rudow for a species which has since been transferred to another genus, *Eurymetopus*, but Piaget, retaining the generic name, has grouped under it a number of species presenting the characters following. This genus "*sert de transition naturelle entre les genres Docophorus et Nirmus d'une part et les genres Goniodes et Lipeurus d'autre part.*") Usually small, 2 mm. being a maximum length among the known species; varying from broad to slender; head conical, clypeus with or without distinct suture, with or without signature; antennæ differing in the sexes, the male antenna longest, and the first three segments with or without appendages; prothorax but little shorter than the metathorax; legs short like those of *Nirmus;* color generally dark brown. But few species (eleven) so far described.

Suborder AMBLYCERA.

With the antennæ clavate or capitate, 4-segmented, and with filiform 4-segmented labial palpi.

Family GYROPIDÆ.

Characters of single genus.



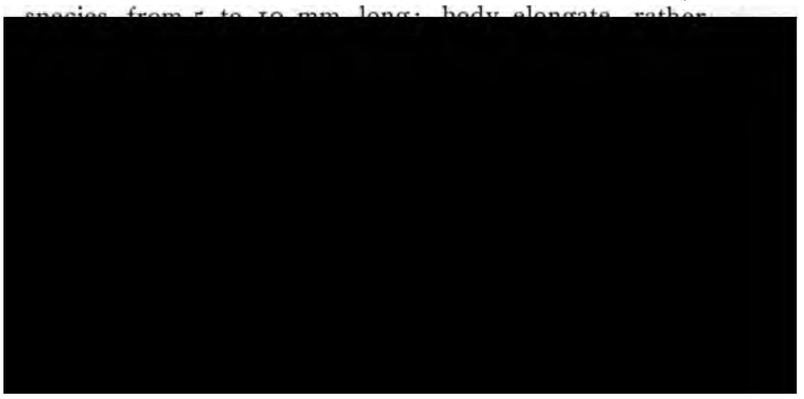
with distinct ocular emargination; eye located in the posterior portion of the emargination, simple or semi-divided by an emargination; temples usually swollen or "winged" with rounded or nearly straight lateral margin; just behind the eye and along the anterior margin of the temple a series of fine short hairs, the "ocular fringe"; the 4-segmented labial palpi extending beyond the lateral margins of the head; the 4-segmented antennæ with first segment short, cylindrical, second, conical, truncated, third goblet-shaped, fourth cylindrical or ovoid usually obliquely truncated; prothorax usually longer than metathorax, with produced lateral angles and bearing a pale or uncolored transverse line which does not extend into the lateral angular regions; mesothorax indicated by a slight constriction and sometimes by an uncolored transverse line across the metathoracic segment; first segment of tarsus short, with a small flat lobe or plate, second very long and slender; abdomen with nine segments, the posterior one differing in the sexes, with distinct dorsal and ventral posterior borders. Color whitish or yellowish with pale to dark brown markings. The genus contains many species, found on all birds except ostriches.

Genus *Boopia* Piaget. The single species upon which this genus is established by Piaget was found by him in company with individuals of *Colpocephalum truncatum* on *Phascolomys fossor*, a wombat! Can these true Liotheid forms have been stragglers from some bird host to this mammalian host? The characters of the genus, as shown by the one species, are: Body about 2 mm. long; head rounded in front, ocular emargination wide but shallow, situated more anteriorly than in other Liotheidæ; eye hemispherical, very large, located in the anterior portion of the ocular emargination; temples angularly produced; the palpi passing the margins of the head by three seg-

ments; the antennæ with second segment subspherical, third pedunculated, fourth the largest; thorax much as in *Colpocephalum;* legs, long and hairy; abdomen of eight (?) segments. The middle of the head and borders of the abdomen yellowish; the rest of the head, thorax and abdominal blotches tawny.

Genus *Trinoton* Nitzsch. (Plate xiii.) Body large, from 2 to 6 mm. long; head, triangular, with rounding angles, with projecting rounded temples, and convex arcuated occipital margin; antennæ, short and concealed, palpi projecting beyond lateral margins of forehead; eye prominent and emarginated, appearing double; the whole thorax very long, in one species larger than the abdomen; mesothorax separated from metathorax by distinct suture (the diagnostic character of the genus); legs long, strong and haired; first segment of tarsus short, with two narrow and acute lobes, second long with two small lobes near the extremity; abdomen elongate oval, nine segments, the posterior segment being rounded behind in the female and trilobed in the male. Color whitish, with brown or reddish brown blotches and black bands.

Genus *Læmobothrium* Nitzsch. (Plate xiv.) Large species from 5 to 10 mm. long; body elongate, rather



from tawny to blackish brown on a whitish ground. Found on birds of prey, and certain water birds.

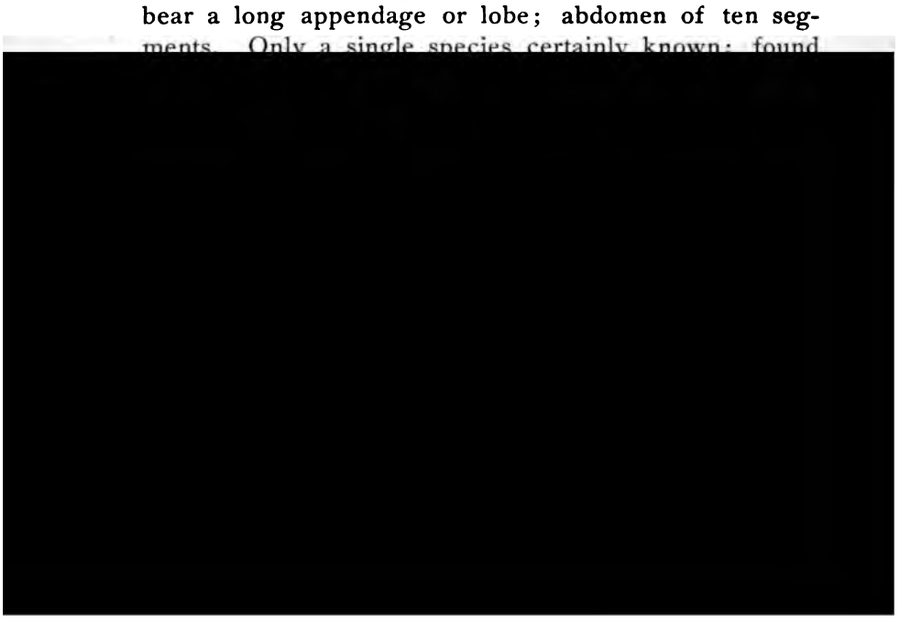
Genus *Physostomum* Nitzsch. Species large, from 2½ to 5 mm. long; body elongate; head broadly conical, straight or a little concave on the lateral margins, without ocular emarginations; broad and usually truncate or flatly convex in front; temporal corners angulated; the under side of the forehead with two small motile muscular lobes projecting slightly beyond the lateral margins, characteristic marks of the genus; palpi prominent; antennæ very short, always concealed in their furrows; thorax longer than the long head; meso- and metathorax completely fused, the posterior width of the metathorax same as anterior width of first segment of abdomen; legs robust, little colored and with few hairs; first segment of tarsus with a small double lobe; second segment rather short. Abdomen elongate elliptical, ninth segment broad and rounded. Color clear pale brown to yellowish, abdomen with lateral bands. The species are few and have been found as yet exclusively on passerine birds.

Genus *Eureum* Nitzsch. Body large, head and abdomen very wide, and metathorax very short; head without ocular emargination and with temples very much enlarged and rounded; antennæ concealed in their cavities; the palpi never projecting beyond lateral margins of the head; thorax about same length as the head; prothorax concave before and behind; the shorter metathorax of the same form as first segment of abdomen; legs long, second segment of tarsus very long; abdomen with acute posterior angles of segments, and hairy. But two species are known, one found on a swallow and the other on the chimney swift.

Genus *Nitzschia* Denny. Body of medium size, about 2 mm. long; head with small ocular emargination, and a

slight but distinct emargination of the lateral margin in front of the ocular emargination, being about where the projecting palpi pass the margins of the head; head wider than long, temples expanded and angulated in front and behind; antennæ short and entirely concealed in their cavities; palpi rather long and projecting beyond margins of the head; prothorax hexagonal with obtuse angles; the mesothoracic suture slightly indicated on the lateral margins; legs long and only slightly colored, first tarsal segment very short with a small acute lobe, second segment larger; abdomen similar in the sexes, obovate, widening posteriorly, with broad lateral bands. Color tawny, blotches ferrugineous, and lateral bands dark reddish brown. Only one species certainly known; found only on the chimney swift.

Genus *Ancistrona* Westwood. (Plate xiii.) Body very large, 6 mm. long and 2½ mm. wide; head crescentic, without ocular emargination; with two 2-pointed strongly-chitinized processes on ventral aspect of hind head projecting backward beyond occipital margin of the head; antennæ concealed in ventral cavities; the lateral palpi short. Prothorax as large as the head; the metathorax like an abdominal segment; the coxæ of the front legs bear a long appendage or lobe; abdomen of ten segments. Only a single species certainly known; found



short, first two segments truncated, conical, the second rarely with a short appendage, the third usually pedicellated and goblet-shaped, receiving the spherical or ovoid or cylindrical fourth into this open mouth; the fourth is always the largest of the four segments; mesothorax fused with metathorax; legs long, first segment of tarsus very short with a lobe of variable form, second long with a small chitin plate often swollen at its extremity; abdomen differs in the sexes, both as to general form and specially as to the last (ninth) segment; posterior border of ninth segment of female fringed with fine hairs which are not present in male. Color whitish or yellowish with darker markings. This is a very large genus, infesting all kinds of birds.

Terminology.

By means of the following definitions and accompanying figures the student will be enabled to understand, it is hoped, the special descriptive and structural terms used in the synopses, keys and descriptions of Mallophaga. Most of these terms are the English equivalents, as nearly as possible, of the terms used in the French and German monographs. A few of them are here first used.

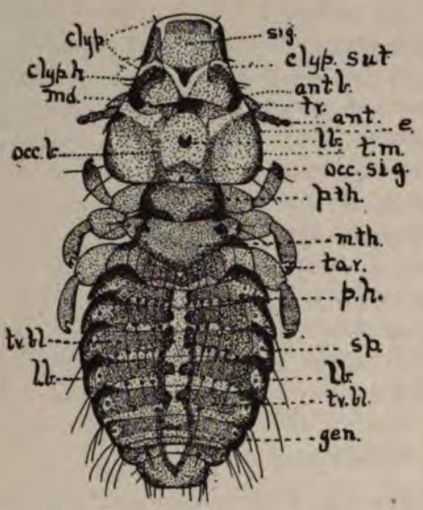


Fig. 1. *Docophorus fuliginosus* Kell., male; *clyp.*, clypeus; *clyp. sut.*, clypeal suture; *clyp. h.*, clypeal hair; *sig.*, signature; *md.*, mandibles; *ant.*, antenna; *tr.*, trabecula; *e.*, eye; *occ. b.*, occipital band; *ant. b.*, antennal band; *lb.*, chitinized part of labium; *occ. sig.*, occipital signature; *pth*, prothorax; *mth.*, metathorax; *tar.*, tarsus; *p. h.*, "pustulated" hairs; *tr. bl.*, transverse blotch; *l. b.*, lateral band; *sp*, spiracle; *gen.*, genitalia.

ANTENNAL APPENDAGE (fig. 2). A projecting process on the first or third segments of the antennæ of the males of certain genera. This appendage may be simply a slight projection of one side of the distal extremity of the segment, or may be long and curving, and may arise from the middle of the segment.

ANTENNAL BANDS (*ant. b.*, fig. 1). Pale to dark-colored chitinous bands extending along the lateral margins of the forehead, interrupted and divided into two parts when the clypeal suture is distinct, sometimes divided into three parts (*Nirmi nigropicti*).

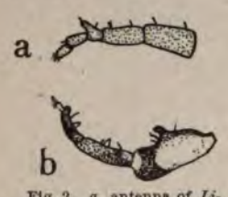


Fig. 2. *a*, antenna of *Lipeurus baculus* ♂; *b*, antenna of *Lipeurus ferox* ♂.

ANTENNARY FURROWS (*ant. f.*, fig. 3). The furrows on ventral aspect of head of members of the Liotheidæ in which the antennæ lie, concealed from dorsal view.

CLYPEAL HAIRS (*clyp. h.*, fig. 1). Usually short, fine hairs on the margins, frontal and lateral, of the clypeus.

CLYPEUS (*clyp.*, fig. 1). That part of the head in front of the clypeal suture; prominent throughout the group.

CLYPEAL SUTURE, or, in descriptions of the head, the *suture* (*clyp. sut.*, fig. 1). The distinct or indistinct suture separating the clypeus from the rest of the head; when distinct, appearing as a narrow uncolored line; when indistinct, usually recognizable on the lateral margins of the head by a small emargination.

FOREHEAD That part of the head in front of the mandibles and antennæ.

GENITAL BLOTCH. Abdominal markings on the under side of the last segments of the female; sometimes single and median, sometimes paired and lateral.

GENITALIA (*gen.*, fig. 1). The colored chitinized parts of the genitalia, often showing through the surface of the body.

HIND-HEAD. That part of the head behind the mandibles and antennæ.

INTER-COXAL LINE (*i. c. l.*, fig. 4). A sternal marking consisting of a colored line or narrow band running transversely between two coxæ of the same side.

LATERAL BANDS (*l. b.*, fig. 1). The dark or transparent lateral margins of the abdomen.

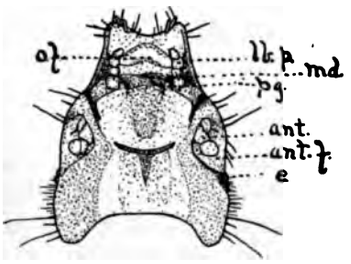


FIG. 3. Under side of head of *Læmobothrium similis* Kell.; *of.*, oral fossa; *lb. p.*, labial palpus; *md.*, mandible; *pg.*, paraglossa; *ant.*, antenna; *ant. f.*, antennary furrow; *e.*, eye.

LABIAL PALPI (*lb. p.*, fig. 3). The 4-segmented labial palpi, present only among the Liotheidæ; usually projecting laterally beyond the lateral margins of the forehead.

METATHORAX (*m. th.*, fig. 1). As the meso- and metathorax are in most genera of the order fused into a single segment; the term metathorax used when no mention is made of the meso-thorax is intended to apply to this compound segment.

OCCIPITAL BANDS (*occ. b.*, fig. 1). Pale to dark-colored chitinous bands extending from the occipital margin forward to the mandibular rami.

OCCIPITAL MARGIN. The posterior margin of the head.

OCULAR BANDS. Bands extending from the eyes to the anterior extremities of the occipital bands.

OCULAR BLOTCH. A colored blotch contiguous to the inner margin of the eye.

OCULAR EMARGINATION. An emargination of the lateral margin of the head, the eye lying in the emargination though near the posterior end of it.

OCULAR FLECK. A small intensely black spot of pigment in the eye.

ORAL FOSSA (*o.f.*, fig. 3). A furrow lying in front of the mandibles.

OCULAR FRINGE. A series of closely set small hairs on the posterior half of the inner margin of the ocular emargination and extending to and sometimes on the temporal margin; especially characteristic of *Menopon* and *Colpocephalum*.

PUSTULATED HAIRS (*p. h.* fig. 1). Hairs rising from uncolored (unchitinized) spaces.

SIGNATURE (*sig.*, fig. 1). A colored blotch on the clypeus, usually with a posterior acuminate point. The *occipital signature* is a usually subcircular colored blotch on the under surface of the hind-head, often showing through above.

Fig. 4. Ventral aspect of thorax and first abdominal segment of *Nirmus præstans* Kell.; *cox.*, coxa; *i. c. l.*, intercoxal line; *m. bl.*, median sternal blotch; *m bl. a.*, median blotch of abdominal segments.

STERNAL MARKINGS (fig. 4). Colored blotches and lines on the ventral aspect of the thorax.

TEMPORAL MARGINS (*t. m.*, fig. 1). The lateral margins of the hind-head.

TRABECULÆ (*tr.*, fig. 1). Two processes, one on each side of the head, projecting laterally from the anterior angle of the antennary fossa; largest and movable in *Docophorus*.

TRANSVERSE BLOTCHES (*tv. bl.*, fig. 1). The colored blotches, one on each lateral half of each abdominal segment.

COLLECTIONS MADE.

The specimens which I have had for study have been collected by me from newly-killed birds, or from freshly-made skins under the following circumstances:

(a) A collection made at Lawrence, Kansas, during the years 1889–1892, exclusively from newly-killed birds, the birds determined by me, and in most cases collected by me.

lection of any set of specimens in order that he may weigh fairly the probable accuracy of the host determinations and the value of any statements as to relative abundance of the individuals of a species, or of the constant or casual occurrence of any parasite species on the individuals of its host species.

A large number of the specimens upon which the monographs of the order are based were collected from the dried skins of birds in various museums. Piaget has found the museum of Leyden a fertile field for collecting. But it is evident that collecting under such circumstances makes uncertain any generalization regarding the abundance of individuals on the host, and the constancy of occurrence of any certain parasite species on any certain bird species. There is also much likelihood of "straggling" and little opportunity to prove or disprove it. On the other hand, in collecting from the newly-killed birds one can practically determine the total parasitic fauna of any bird specimen; and, where a large series of specimens of one bird species is obtained, definite conclusions as to the constant or casual occurrence of a parasite species upon its host can be attained. The collection of immature specimens is practically restricted to collectors from newly-killed specimens because the tender, unchitinized body of the young insect shrivels soon after death; thus the immature insects are rarely found on dried skins. This may account for the absence of references in the European monographs to the immature stages of any of the described species.

Methods of Collecting and Preserving.

The methods of collecting are simple. The parasites do not leave the body quickly after the death of the host, so if there is no opportunity to take them from the host in the field immediately after shooting, they may be col-

lected after the dead birds are brought to the laboratory or museum. Most of my collecting has been done in connection with the collection of the birds for museum purposes. The parasites frequent all parts of the body of the host, but after death of the host are especially to be sought about the lores and base of the bill. Here they seem to congregate, and while sometime after death of the host many parasites leave the body others will stop their traveling at the base of the bill, and rather than leave the body will fasten themselves by claws or mandibles to the short stiff feathers of this region and die there. The death of the parasites which remain on the body after death of the host takes place in from four or five hours to seven days. In most cases all of the parasites are dead at the end of two or three days. It is evident, in face of the fact that after death of host many parasites leave the body, that much care must be taken to prevent "straggling," i. e., parasites from one bird getting upon some other bird which may be conveniently near. In the game-bag each bird should be well wrapped in paper, or, as is common with collectors, placed in a paper cone head downwards.

In addition to the examination of newly-killed birds, the examination of freshly-made skins may be made, or

in any one vial may be assorted into species putting each species in a vial by itself and giving this vial the same accessions number as the original vial and in addition a sub-number or letter. In my catalogue of accessions there are entered under each accessions number the sub-numbers or letters with specific name of the parasites when determined. By this plan, any specimen of parasite can be traced at any time to the individual bird from which it came, and statistics of abundance on the host, of number of individuals of a single species, or of the constant or casual occurrence of a parasite species on a host species can be compiled. Also, the parasitic faunæ of different specimens of the same bird-species from different localities can be critically compared.

The alcohol modifies the specimens but little; their hard chitin covering prevents appreciable shrinking, and the colors are due chiefly to the excess or scantiness of chitinization in different parts of the body, a coloration not much affected by alcohol. Specimens intended for dissection can be well preserved in soft condition in a five per cent. solution of chloral hydrate.

Descriptions of New Species.

Docophorus calvus n. sp. (Plate iii, fig. 1.)

A single female, taken on a California Murre, *Uria troile californica* (Bay of Monterey, California).

Description of female. Body, length 1.7 mm., width .8 mm.; short, broad, small, with golden brown markings, darker on margins, almost without hairs.

Head, length .53 mm., width .56 mm., thus being slightly wider than long; conical, with uncolored frontal part of clypeus slightly expanded and feebly emarginate; suture distinct; lateral margin of head in front of suture slightly concave; temporal margins convex with two hairs, and

one hair in the prominent eye; occipital margin straight; trabeculæ large; signature colored, posterior margin with darker-colored acuminate point, anterior margin parallel with front margin of clypeus, i. e., emarginate; antennal bands distinctly colored and continued in front of suture, and bending in at posterior ends; behind these bent-in ends a diagonally transverse, uncolored line; occipital bands distinct; temporal margins colored.

Prothorax small, short, much narrower than the head; angled behind, with a slight, rounding prominence at posterior lateral angles bearing a single hair; colored, paler in the center. Metathorax short, angled behind, with sides produced and obtusely rounded, bearing one long hair; whole segment strongly colored.

Abdomen broadly elliptical; first segment wholly colored, segments 2–7 with a strong lateral blotch, irregularly triangular, pointed inwardly, with clear stigmatal spot, with uncolored posterior angles, and with one or two hairs arising from extreme posterior lateral point of colored blotch; eight segment wholly colored; ninth uncolored, rounded, with only very small hairs; central space of abdomen uncolored; a rectangular genital blotch with backward projecting posterior angles showing through on sixth and seventh segments.

drius very closely resembles the common *melanocephalus* of the Terns.

Description of the male. Body, length 1.62 mm., width .65 mm.; head and thorax smoky golden brown, abdomen dark brown with black markings.

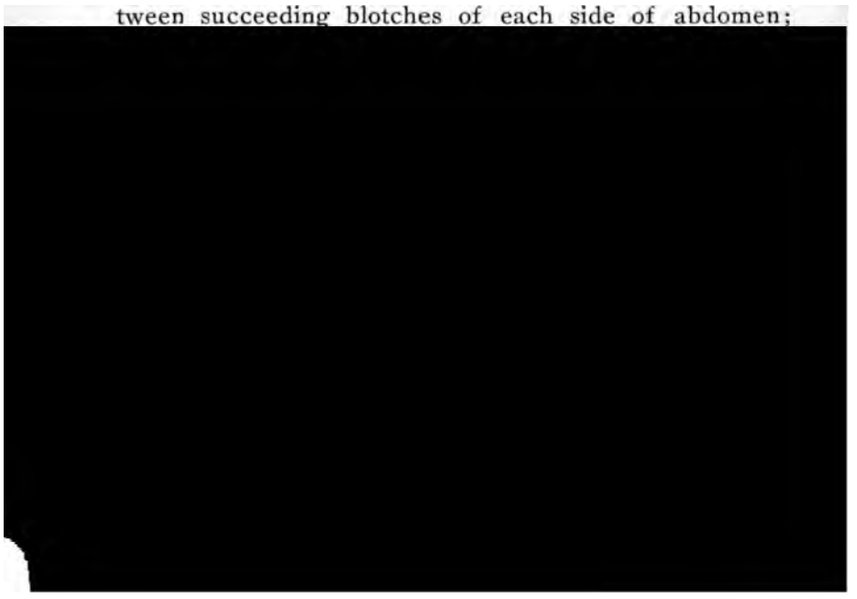
Head, length .60 mm., width .53 mm.; front convex with a narrow uncolored border, and a short hair in each anterior angle; one short, marginal hair in front of the distinct suture, and two behind it; trabeculæ medium; eye inconspicuous, with a short hair; temporal margins with two hairs; occipital margin straight, bare; signature shield-shaped, pale, with acuminate posterior point darker colored; quadrangular space in anterior part of signature slightly darker colored than rest of signature; angulated antennal bands, their continuations in front of the suture as narrow marginal borders, the diverging occipital bands and the marginal temporal borders dark brown; also a narrow occipital border not extending to the sides of the head and interrupted medially.

Prothorax, short, with slightly diverging sides and flatly convex posterior margin; posterior angles with a single hair; color smoky golden brown, with a dark brown lateral border, extending around the posterior angles, and a little way along the posterior margin. Metathorax short, broad, with widely diverging short sides, and broadly parabolic posterior margin thickly set with a series of pustulated hairs. Sternal markings consisting of dark brown intercoxal lines, a pale median prothoracic blotch, and a small, pale, triangular metathoracic blotch. Legs, fuliginous with narrow dark brown to black markings.

Abdomen, broadly ovate, turbinated; segment 2 with specially prominent, acute, projecting, posterior angles; segments 4–8 with one to two hairs in posterior angles;

whole abdomen, except segment 9, strongly colored; segments 2–7 with broad black lateral bands; segments with long, transverse, dark brown blotches barely separated medially by an uncolored line, widest on second segment and narrowing on each successive segment; transverse blotches confluent medially on segment 1, with a small, medial, angulated, uncolored emargination on anterior margin; segments 2–5 with a series of pustulations along posterior margin of each transverse blotch, and behind each series a narrow dark brown transversal line; segment 1 with but two demi-pustulations near mesal end of each transverse blotch; segment 9 with uncolored anterior angles, and a lateral smoky brown blotch with four or five short pustulated hairs; posterior margin truncate with a few rather short hairs; genitalia extending through segments 3–9.

Female, length 2. mm., width .9 mm.; head, length .65 mm., width .65 mm.; transverse blotches of abdomen, except of segment 1, not closely approached mesally; segments 1–6 with series of pustulated hairs along posterior margin of transverse blotch, four hairs in segment 1, six hairs in segments 2–6; blotches on segments 2–5 acute mesally, blotches of segment 6 diagonally truncate, and of segment 7 flatly rounded; a narrow transversal line between succeeding blotches of each side of abdomen;



Description of male. Body, length 2. mm., width .72 mm.; pale golden brown, with characteristic angulated, black, lateral abdominal markings; abdomen Nirmoid, head large and just as broad as long.

Head, length .62 mm., width .61 mm.; broadly conical; clypeus with uncolored, truncated, frontal margin, and rounded angles; a very fine short pair at middle of each rounded anterior angle, and one at the suture; temporal margins with one short prickle and three long hairs; eye with a short hair; trabeculæ broad, acute-angled; antennæ short, thick; signature pale smoky brown, broadly hexagonal; posterior margin slightly rounding; on each side of the signature a similarly colored elongated triangular blotch apex anteriorly; ground color of head pale golden brown with darker mandibles, broad curving antennal bands, narrow temporal margin, and occipital bands convex outwardly; occipital margin straight.

Prothorax, short, broad, a single short hair in posterior angle, and anterior margin deeply emarginated and projecting under the head; broad lateral margins and forward projecting anterior processes dark brown. Metathorax, short, broad, with rounding lateral margins; with a short prickle at rounding anterior angle, a short prickle and long hair in middle of side, and one long and two short hairs at rounding posterior angle; posterior margin slightly convex on abdomen.

Abdomen, long, ovate, with obtuse posterior angles of segments projecting along lateral margin, the angles of segments 1–6 bearing a single hair, 7–8 with two hairs; first segment with brown triangular blotch in anterior angles, segments 2–7 with brown transverse blotches covering almost entire segment; along lateral margins on each segment a sharp blackish angulated line extending forward into preceding segment; inside of this broken

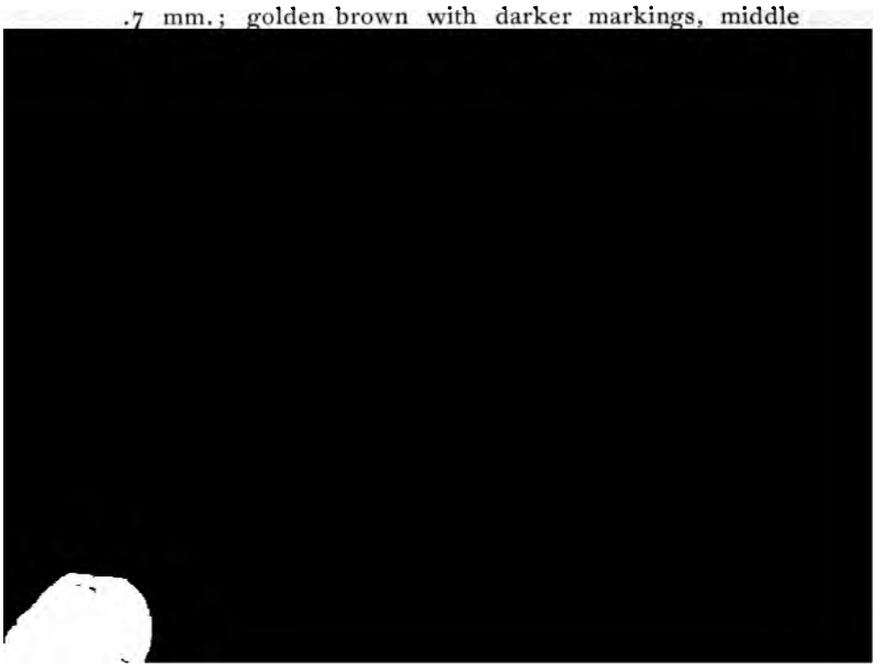
marginal line the stigmatal series, and still inside a faint continuous uncolored line; transverse blotch on segment 8 curving, and the lateral line narrow and sinuous; segment 9 but weakly colored; the genitalia extending forward into the eighth segment, and with distinct small claws at posterior end.

The female specimens were so distorted in preparation as to preclude any careful description. The ninth segment is small but distinct, feebly and broadly emarginated, and has two lateral triangular pale brown blotches. The general abdominal markings similar to male, the characteristic angulated black lateral lines being present.

Docophorus acutipectus n. sp. (Plate iii, fig. 4.)

A single female taken on the Rhinoceros Auklet, *Ceratorhina monocerata* (Bay of Monterey, Cal.) This species resembles *D. celedoxus* Nitzsch, taken on *Alca torda*, *Uria troile* and *Fratercula arctica*, but differs in the absence of sternal markings, the almost failing emargination of the clypeus, the character of the genital blotch of the female, and in the larger size.

Description of female. Body, length 1.94 mm., width .7 mm.; golden brown with darker markings, middle



tinuing in front of suture, behind it angularly curving; occipital bands diverging, and separated from antennal bands by an uncolored line.

Prothorax short with lateral margins obtusely angulated and bearing one hair in angle; broad lateral colored border, anterior border colored, median uncolored space. Metathorax obtusely angled laterally, long and acutely angled on abdomen, three hairs in margin behind lateral angle, broad lateral borders colored. No sternal markings. Legs concolorous with body.

Abdomen elongate ovate; first segment wholly colored except for distinct narrow median uncolored line not reaching quite to posterior border of segment; segments 2–7 with lateral blotches, on segments 2–5 pointed within, on segments 6–7 blunt within; each blotch with stigmatal spot and several wholly or partly enclosed small circular clear spots along posterior margin; segment 8 longer and wholly colored, segment 9 short with two lateral flecks; genital blotch of under side with frontal transverse bar, and extending backward two pointed elongate triangular spaces, lateral ends of the transverse bar diagonally truncate.

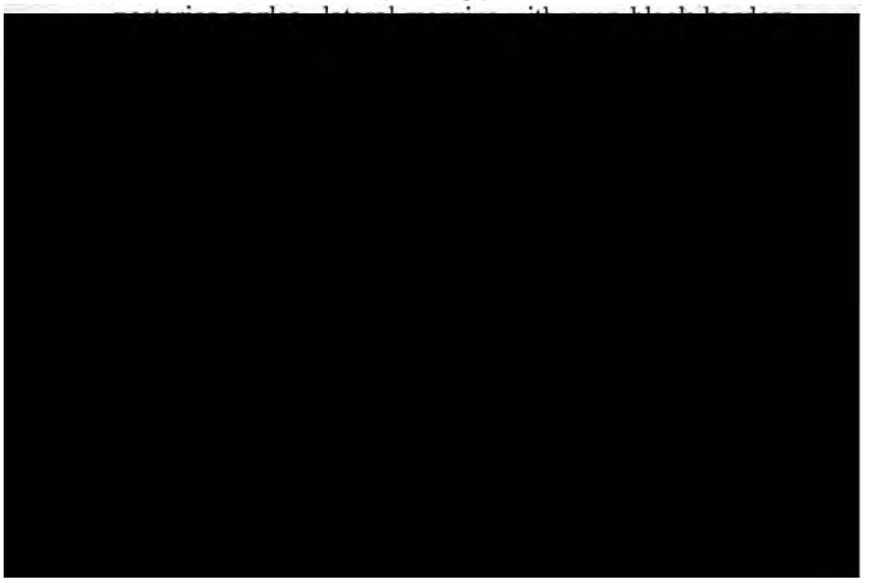
Docophorus quadraticeps n. sp. (Plate iii, fig. 5.)

A male and a female taken from an American Coot, *Fulica americana* (Monterey, California). This species closely resembles *kansensis*, taken from an American Eared Grebe, *Colymbus nigricollis californicus* (Lawrence, Kansas). It differs from it by its larger size, the more rotund abdomen, in the distinctly long acuminate signature, and less markedly in the genital blotch.

Description of female. Body, length 1.87 mm., width .87 mm.; short golden brown with narrow dark margins of thorax and anterior half of abdomen, and short triangular abdominal blotches with few large pustulations.

Head, length .6 mm., width .6 mm.; broadly conical, forehead especially broad; front truncate with a hair on dorsal surface in rounded anterior angle, projecting forward behind the hair two very short ones (not marginal, and showing through from underside), and behind them a very long hair; at suture a short marginal hair, and behind the suture two curving hairs on dorsal surface near the margin and projecting beyond the margin; trabeculæ large, broad and colored at base with rapidly tapering uncolored tip; antennæ, weakly colored, first segment thick, second segment slender as long as first segment, third, fourth and fifth short and about equal; temporal angles with three long pustulated hairs, also a marginal hair just behind the eye and a long one in the eye; occipital margin slightly convex in the middle and slightly concave each side of the middle; signature pale, broad, truncate anteriorly and with long, acuminate, darker colored tip projecting beyond the mandibles; antennal bands pale, interrupted by the distinct clypeal sutures, and coalescing with the much darker, conspicuous, widely diverging occipital bands; temporal margins narrowly edged with black.

Prothorax short with rounding angles, posterior margin flatly convex and a single long pustulated hair behind the



lateral, brown, triangular blotch, with an outer, marginal, narrow, blackish line contiguous to the anterior margin of the segments, but leaving an uncolored space about one-third the length of the segment between the hind margin of blotch and posterior margin of segment; each segment with a single transverse series of long hairs pustulated along the posterior margin of the triangular markings, but not pustulated in the median, uncolored portion of the segment; a conspicuous, clear, stigmatal spot in each blotch; triangle of first segment extending furthest inwards (nearly to median line), and shorter on each succeeding segment; eighth segment wholly colored; ninth segment uncolored, short and emarginated; a large, broadly crescentic, genital blotch with a median, angulated projection in posterior concave border on ventral face of segments 6–7.

Male, length 1.5 mm., width .4 mm.; head, length .53 mm., width .5 mm.; abdomen short, broadly ovate, with triangular blotches prolonged inwardly; ninth segment flatly rounded behind with a few rather long hairs.

Docophorus montereyi n. sp. (Plate iii, fig. 6.)

Abundant on the Ancient, Marbled and Aleutian Murrelets, *Synthliborhampus antiquus*, *Brachyrhampus marmoratus* and *Ptychorhampus aleuticus* (Bay of Monterey, California). Specimens were taken from forty-six individuals out of fifty-five birds of these species shot.

Description of male. Body, length 1.56 mm., width .53 mm.; head large, pale golden brown, abdomen dark, thorax and abdomen with black lateral border.

Head, length .47 mm., width .43 mm.; uncolored front of clypeus very slightly expanded, rounded with a single marginal hair on the side in front of the suture; trabeculæ large reaching almost to the middle of the second antennal segment; antennæ with first segment thick and about as long as second, third and fourth very short, equal,

fifth longer than third or fourth; eye with short curving hair; temporal margins with two hairs; occipital margin straight, even slightly convex noticeable at least medially; color pale smoky brown; signature shield shaped with produced acuminate posterior angle not reaching the mandibles, darker colored; antennal bands dark brown, distinct, posterior ends turning diagonally inwards, anterior ends where interrupted by the suture turning in toward the base of the point of the signature, and tapering to an acuminate point; occipital bands dark brown, narrow, uniform, widely diverging, and separated from the antennal bands by a pale diagonal space; region immediately contiguous to the eye dark brown.

Prothorax short, broad, sides diverging, a single long hair in posterior angles; hexagonal, the middle third of the posterior margin making a very obtuse but distinct angle with the lateral thirds; a broad, uniform, dark brown to black border on the lateral margins and lateral thirds of the anterior and posterior margins. Metathorax with sides rapidly diverging; posterior margin with rounding angle on the abdomen, and a series of about fourteen pustulated hairs ranged along its entire length from lateral angle of one

these blotches and lines black along lateral margin of body forming broad, black, lateral, abdominal bands; the blotches and lines separated medially by a pale, almost uncolored space on segments 2–5; on segments 6–7 and on posterior half of segment 5 the blotches and lines coalesce on the median line; several pustulated hairs ranged along posterior margins of blotches on segments 2–6; last segment flatly rounded posteriorly with several longish hairs, a curving, transverse, medial blotch, and regions of the anterior angles uncolored.

Female, with transverse blotches of segments 2–7 of abdomen very short, beginning with anterior segments successively acute, diagonally truncate, and truncate on inner ends, the usually three pustulated hairs conspicuous; large medial space of abdomen whitish; last segment fuscous, with five longish hairs in two groups, one of two and one of three, on each side; measurements, length 1.75 mm., width .7 mm.; head, length .53 mm., width .51 mm.

Docophorus occidentalis n. sp. (Plate iii, fig. 7.)

An abundant species on the Pacific Coast varieties of the Fulmar, *Fulmarus glacialis pacificus* and *F. g. rodgersii;* found on twenty-nine of thirty of these Fulmars shot on the Bay of Monterey, California. Two specimens, probably stragglers, taken on two Surf Scoters, *Oidemia perspicillata* (Bay of Monterey).

Description of the male. Body, length 1.56 mm., width .7 mm.; short, broad, strongly-colored, with black abdominal bands and triangular, lateral, abdominal blotches.

Head, length .53 mm., width .53 mm.; conical, with truncate or weakly convex front; three very small marginal hairs, one of which is slightly in front of suture; trabeculæ reaching slightly beyond base of the second antennal segment; antennæ colored except at sutures,

second segment longest, third, fourth and fifth segments about equal; temporal angles with two hairs; eyes with a short spine; occipital margin straight or slightly convex; signature broadly shield-shaped, constricted near the front, anterior margin truncate or slightly emarginated, posterior margin with a darker colored obtuse angle; angulated antennal bands dark colored and specially distinct; occipital bands distinct, widely diverging, and interrupted by a diagonally transverse uncolored line; temples dark brown, narrowly margined with black; occipital margin between bases of occipital bands with border of same width and color as occipital bands, paler in the middle.

Prothorax short, broad with slightly diverging sides and rounded posterior angles, with one hair; with marginal lateral bands bending inwards along posterior margin. Metathorax pentagonal, angled on abdomen, with a series of seven pustulated hairs ranged along latero-posterior margins beginning at lateral angles; last hair of each series removed from others and near the posterior angle; segment mostly brown, with a dark lateral blotch in each lateral angle extending indistinctly along latero-anterior sides. Legs light brown, with dark brown markings. Sternal markings consisting of a short, broad,

near the apex, all along the posterior margin of the triangle; segment 1 with one pustulated hair near the middle, and segment 7 without hairs; segment 8 with narrow curving, transversal, nearly continuous brown band, and segment 9 wholly colored but paler; outer margin of each triangle broadly black, producing black lateral abdominal bands; posterior margin of segment 9 flatly rounded, with about ten longish hairs; segments 3–7 with one to three longish hairs in posterior angles; genitalia extending forward to third segment, and posterior pincer-like portion very strong.

Female. Body, length 1.8 mm., width .78 mm.; head, length .53 mm., width .53 mm.; pustulated hairs of metathorax at subequal distances apart; triangular blotches of abdomen not projecting so far inwardly, and with but two pustulated hairs; segment 8 wholly colored; segment 9 very small, uncolored, with two small lateral blotches, posterior end truncate, and with one short spine at each posterior angle; genital blotch on ventral face of segments 6–7, transverse anteriorly, with two posteriorly projecting pointed processes.

Docophorus kansensis n. sp. (Plate iii, fig. 8.)

A single female specimen taken from an American Eared Grebe, *Colymbus nigricollis californicus* (Lawrence, Kansas). The new form somewhat resembles *colymbinus* (Piaget, Les Pediculines, 1880, p. 117, pl. x, fig. 5, from *Colymbus septentrionalis*), especially in the shape and markings of the head; but the well-defined and characteristic abdominal markings are very different from the abdominal markings of *colymbinus*.

Description of female. Body, length 1.6 mm., width .64 mm.; pale golden brown, with darker, narrow, thoracic borders and short, lateral, triangular, abdominal blotches bearing a few, long, pustulated hairs.

Head, length .47 mm., width .44 mm.; broadly conical, front broad, slightly convex with a shallow median emargination; a hair arising from the dorsal surface near the obtuse anterior angle projects forward beyond the margin; behind this two short hairs (not marginal and showing through as in n. sp. a) and behind these a rather long hair; two short marginal hairs: trabeculæ long and rather slender, acutely-tipped: antennæ long; temporal angles with three hairs, also one hair just behind the eye, and one in anterior angle of eye: occipital border slightly convex: forehead much paler colored than hind head; signature short with slightly concave anterior margin and obtusely angled hinder margin: antennal and internal bands pale, temples and widely separated occipital bands darker.

Prothorax subquadrangular: rounded posterior angles with one hair; posterior border straight: distinct, regular, colored lateral borders. Metathorax pentagonal; with two non-pustulated hairs in lateral angle and five pustulated hairs ranged along each latero-posterior margin: uniform lateral colored border. Legs pale colored except tarsi and claws.

Docophorus atricolor n. sp. (Plate iii, fig. 9.)

Not uncommon on the Ancient and Marbled Murrelets, *Synthliborhampus antiquus and Brachyrhampus marmoratus* (Bay of Monterey, California). This species is closely related to *colymbinus*.

Description of male. Body, length 1.75 mm., width .71 mm.; rather elongate, Nirmoid in shape, darkly colored all over with wide, black, lateral, abdominal bands.

Head, length .53 mm., width .6 mm.; slightly broader than long, front broad, with shallow rounding emargination, uncolored portion of clypeus slightly expanded, anterior angles rounding; one very short fine marginal hair at indistinct suture; trabeculæ small; antennæ short and slender; temporal margins with two long hairs; eyes flat with a spine; occipital margin concave; clypeal signature broad anteriorly, with truncate front margin, tapering slowly posteriorly to truncate, posterior margin reaching the mandibles; antennal bands darkly brown, right-angled, with posterior ends extending transversely inwards to mandibles; occipital bands distinct, slightly diverging and separated from forehead by a transverse, weakly colored, linear space behind antennal bands; temporal regions brown with margins darker.

Prothorax, small with anterior margin emarginated and projecting under the head; lateral and anterior margins distinctly and evenly bordered with dark brown to black, rest of segment brown; a short spine on lateral margin, and at rounded posterior angle a single hair. Metathorax short, broad, posterior margin flatly convex, angles rounded; a long hair and short spine in an uncolored space in front of middle of lateral margin, and three long hairs in posterior angle; segment wholly colored with darker, small, lateral, marginal blotch, in which is located the clear space containing hair and spine. Legs brown with darker markings.

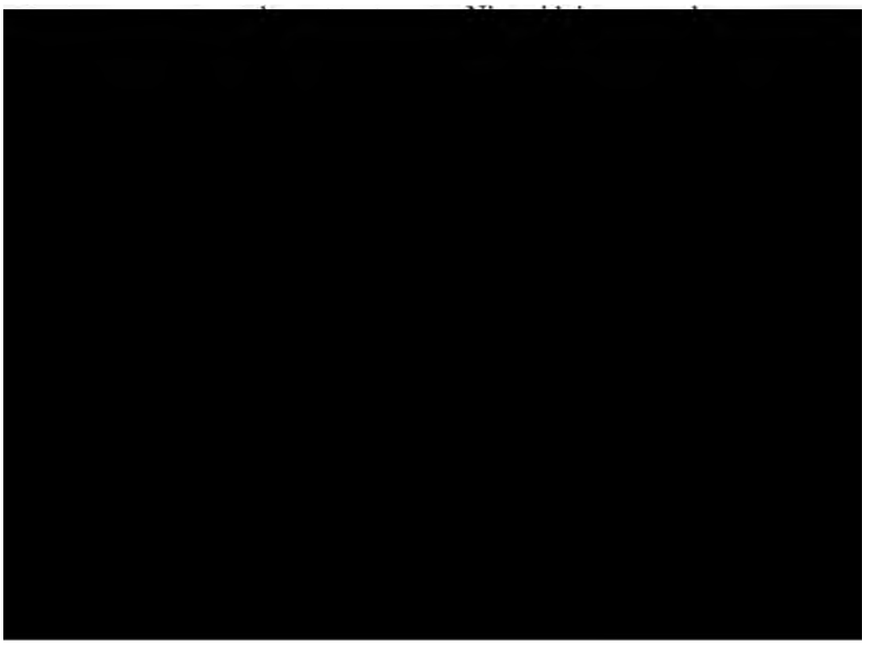
Abdomen elongate, elliptical, segments short of about equal length; each segment with two weak median hairs on dorsal surface; whole colored dark smoky brown except tip of ninth segment; broad black lateral bands, connected on each segment by a narrow transverse black bar across middle of segment; on first segment this bar broader, covering nearly whole surface of segment, and with a narrow uncolored median line; ninth segment truncate behind with flatly rounded posterior angles; a series of short pustulated hairs along posterior margin; genitalia in segments 8 and 9, side pieces with a distinct toothed posterior claw.

Female, same size; not so dark; ninth segment emarginated for one-half its length, the points being obtusely angled, and with one very short hair each.

Docophorus insolitus n. sp. (Plate iv, fig. 5.)

A few specimens, male and female, taken from an Aleutian Murrelet, *Ptychorhampus aleuticus* (Bay of Monterey, California). This species was not found on other of the numerous individuals of the same bird species taken at Monterey.

Description of female. Body, length 1.65 mm., width



large, blunt; eye with a short hair; temporal angles rounded, with two rather short curving hairs; occipital margin straight; bands of the head, viz., broad antennal, diverging occipital, distinct ocular reaching the tips of the occipital, and narrowly marginal, dark brown and well marked; pale brown signature large, with dark brown posterior angle not reaching mandibles and rather blunt.

Prothorax short, broad, with rounded angles and convex posterior margin; one hair in posterior angles; distinct dark brown lateral and anterior borders, also extending inwards from the posterior angles along the posterior margin, but not meeting; median space almost uncolored. Metathorax pentagonal, with rounding lateral angles and six hairs on each latero-posterior margin; broad lateral dark brown border, broadest in lateral angles. Legs concolorous, with pale brown tinge of body, tarsal claws darker.

Abdomen elongate, narrow, posterior angles of segment 2 produced, acuminate; lateral margins with two longish hairs, a few longish hairs on dorsal aspect; lateral bands semitranslucent smoky brown, composed of a series of slightly diagonal, narrow, marginal blotches, one on each segment, each blotch widest anteriorly, tapering posteriorly and not quite reaching the posterior angle of the segment; segments 1–7 with lateral transverse blotches, those on segment 1 meeting on the median line; large median region of abdomen whitish; segment 8 wholly colored; segment 9 small, uncolored, with very slight angular emargination; genital blotch a narrow, curving, transverse band across segment 6.

Male. Smaller, length 1.34 mm., width .38 mm.; head, length .47 mm., width .37 mm.; metathorax almost wholly fuscous; the lateral transverse blotches of abdomen longer, those on segments 6–7 almost, if not quite,

meeting on median line; last segment broadly rounded with several hairs; genitalia pincer-like.

Docophorus icterodes Nitzsch. (Plate iv, fig. 1.)

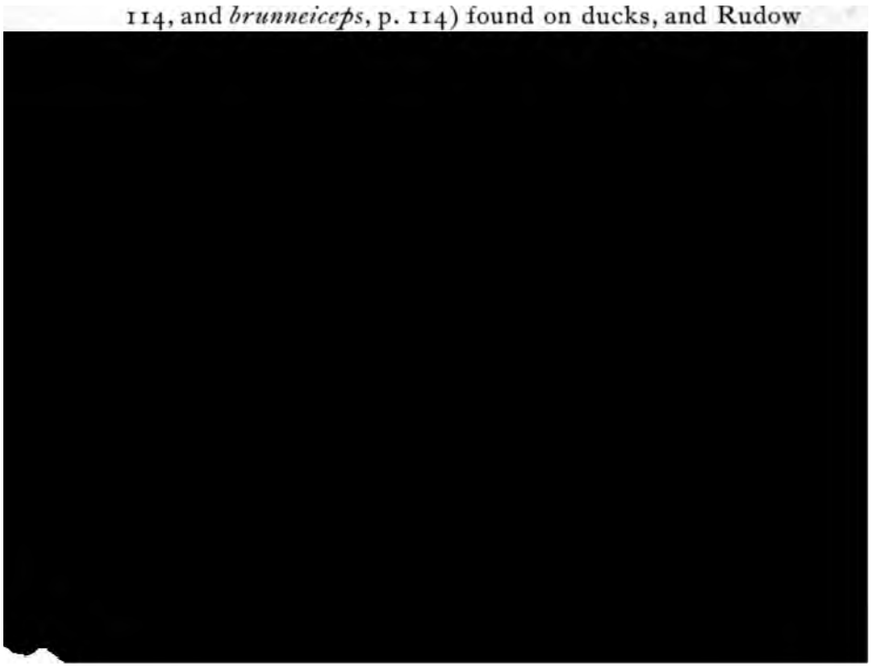
Germar's Mag. Entomol., 1818, vol. iii, p. 290.

Pediculus dentatus Scopoli, Entomol. Carniol., 1763, p. 383.

Docophorus icterodes Nitzsch, Burmeister, Handbuch d. Entomologie, 1832, vol. ii, p. 424; Gurlt. Mag. f. ges. Thierheilk., 1842, vol. viii, p. 415; Denny, Monograph. Anoplur. Brit., 1842, p. 101, pl. v, fig. 11; Grube, v. Middendorff's sibir. Reise., 1851, vol. ii, part 1, p. 468; Giebel, Insecta Epizoa, 1874, p. 115, pl. x, fig. 8; Piaget, Les Pediculines, 1880, p. 114, pl. x, fig. 1.

Specimens of this common parasite of ducks taken on the Surf Scoter, *Oidemia perspicillata*, the Ruddy Duck, *Erismatura rubida*, the Red-breasted Merganser, *Merganser serrator* (Bay of Monterey, California); and from the Mallard, *Anas boscas*, the Greenwinged Teal, *Anas carolinensis*, the Redhead, *Aythya americana*, the Lesser Scaup, *Aythya affinis*, and the Pintail, *Dafila acuta* (Lawrence, Kansas). Piaget, Giebel and Denny list fully a dozen species of ducks on which *icterodes* has been found.

Giebel has described (Insecta Epizoa) three other species of *Docophorus* (*adustus*, p. 113, *brevimaculatus*, p. 114, and *brunneiceps*, p. 114) found on ducks, and Rudow



ored signature, and on each side of it the triangularly-headed anterior projection of the antennal band.

Docophorus pertusus Nitzsch. (Plate iv, figs. 2 and 3.)

Germar's Mag. Entomol., 1818, vol. iii, p. 290.

Docophorus pertusus Nitzsch, Burmeister, Handbuch d. Entomologie, 1832, vol. ii, p. 426; Giebel, Insecta Epizoa, 1874, p. 108, pl. xi, figs. 3, 12; Piaget, Les Pediculines, 1880, p. 89.

Males, females, and young from eight out of eleven specimens of American Coot, *Fulica americana* (Monterey, California), and from one out of three specimens of same bird species taken at Lawrence, Kansas. A single specimen was taken from a Ruddy Duck, *Erismatura rubida* (Monterey, California). The Ruddy Ducks and Coots are such constant associates that it is not surprising to find this Coot parasite occasionally on this species of duck. Also a single male was taken from an American Eared Grebe, *Colymbus nigricollis californicus* (Bay of Monterey, California). The characteristic forcipated appearance of the clypeus easily distinguishes the species; in some specimens the "pincers" will be found closed, so that the deep frontal emargination is quite enclosed, while in others the "pincers" will be open. My specimens do not agree with Giebel's figures and Piaget's description as to length of signature; in my specimens the acuminate posterior point extends quite to the mandibles. I figure a female, and an immature specimen. The young stage is interesting, as it shows no evidence of the pincer-like condition of the clypeus, and the clypeal signature is arrested far in front of the mandibles. The measurements of the specimens figured are: Female, body, length 2. mm., width .92 mm.; head, length .6 mm., width .6 mm. Immature, body, length 1.7 mm., width .84 mm.; head, length .52 mm., width .5 mm. Nitzsch's specimens were found on *Fulica atra*.

Docophorus lari Denny. (Plate iv, fig. 4.)

Monograph Anoplurorum Britanniæ, 1842, p. 89, pl. v, fig. 9.

Pediculus lari Fabricius, Fauna Groenlandica, 1780, p. 218.

Philopterus lari Fabr., Walckenær, Hist. Nat. Ins. Apt., 1844, vol. iii, p. 337.

Docophorus gonothorax Giebel, Zeitschr. f. ges. Naturwiss., 1871, vol. xxxvii, p. 450; Giebel, Insecta Epizoa, 1874, p. 111.

Docophorus congener Giebel, Insecta Epizoa, 1874, p. 111.

Docophorus lari Denny, Piaget, Les Pediculines, 1880, p. 111, pl. ix, fig. 7.

Many specimens of this common parasite of the gulls on *Larus argentatus smithsonianus*, *canus*, *occidentalis*, *brachyrhynchus*, *glaucescens*, *heermanni*, *vegæ*, *delewarensis*, *glaucus* and *Rissa tridactyla pollicaris* (Bay of Monterey, Cal.), and from *Larus delewarensis* (Lawrence, Kansas). In all, I have examined eighty-seven specimens of gulls of the various species mentioned, and have collected this parasite on seventy-eight of them. Piaget and others have found this parasite on *Larus canus*, *marinus*, *fuscus*, *glaucus*, *argentatus*, *ridibundus*, *atricilla*, *islandicus*, *leucophæus*, *cyanorhynchus*, *Pagophila eburnea*, *Rissa tridactyla*, *Sulla bassana*, and *Lestris parasiticus*. I have found males, females and young of this parasite on *Colymbus nigricollis californicus* and *Urinator lumme;* these

Despite the smaller size I do not understand, from the description, how Picaglia's *D. larinus* (Atti d. Soc. Ital. d. Sci. Nat., 1885, vol. xxviii) differs specifically from *lari*.

Docophorus melanocephalus Burmeister. (Plate iv, fig. 6.)

Burmeister, Handbook d. Entomologie, 1832, vol. ii, p. 426.

Docophorus laricola Nitzsch. (*in pars*) Zeitschr. f. ges. Naturwiss. (ed. Giebel) 1866, vol. xxviii, p. 363.

Docophorus caspicus Nitzsch. Zeitschr. f. ges. Naturwiss. (ed. Giebel) 1866, vol. xxviii, p. 361, fig. 87.

Docophorus melanocephalus Burm. Giebel, Insecta Epizoa, 1874, p. 110, Pl. xi, fig. 8; Piaget, Les Pediculines, p. 109, pl. ix, fig. 5.

Many specimens taken from the Royal Tern, *Sterna maxima*.

This is the most abundant parasite of this Tern (Bay of Monterey, California). I found it on every one of fourteen specimens shot. The European authors record its occurrence on *Sterna caspia*, *cantiaca*, and on *Larus ridibunda* and *cirrocephalus* (localities?). Giebel describes also as a distinct species *lobaticeps* (Insecta Epizoa, p. 109), a closely related, if not identical, form taken on *Sterna hirundo* and *Sterna fissipes*. Piaget believes *lobaticeps* to be identical with *melanocephalus*.

The distinguishing characters of *melanocephalus* are its general dark color, its especially dark colored head, prominent signature with long acuminate point reaching the mandibles, slightly convex clypeal front, and the presence of a small spine and a short hair in the eye. The measurements of the female specimen figured are: Length 2.1 mm., width .9 mm.; head, length .65 mm., width .65 mm.

Nirmus præstans n. sp. (Plate v, figs. 1 and 2.)

Taken on the Royal Tern, *Sterna maxima* (Bay of Monterey, California). But two specimens, both males,

of this new *Nirmus* were taken, one from each of two birds. The new form belongs to the group *nigropicti*.

Body, length 3.25 mm., width .5; with marginal markings of black, and abdominal blotches of chestnut brown.

Head, length .56 mm., width .5 mm.; broadly conical, widest at posterior angles, with temporal margins and margins of forehead in nearly straight diagonal lines; clypeus truncate in front (even slightly concave), with three lateral short hairs; signature with broad anterior margin colored (brown); a rather broad lateral black line interrupted posteriorly by the suture, but reappearing behind the suture as a black blotch; antennal bands black, outer ends curving forward; trabeculæ distinct, as long as first antennal segment; antennæ with second segment longest, fifth longer than third or fourth which are equal, uncolored, except the fifth segment, which is light brown with distinct short hairs on tip; eyes with a bristle; temporal margins narrowly bordered with black and with one long hair; occipital angles rounded, posterior border doubly emarginated; occipital signature black and labium brown, visible on under side; mandibular rami strongly colored.

Prothorax quadrangular, much narrower than head,

markings consisting of broad intercoxal lines, and a triangular median blotch on metathorax. Legs mostly uncolored, with femur semiannulated with dark brown at basal and distal extremities; tibiæ annulated at distal end; tarsus light brown; claws uncolored.

Abdomen, elongate ovate; posterior angles of segments with few hairs; surface glabrous, first segment without transparent lateral margin, with circular black spot in anterior angle; segments 2–6 with transparent lateral margin, narrower posteriorly; in each anterior angle a black, linear, obliquely directed blotch produced anteriorly across the suture and into the preceding segment; on segment 7 this blotch very faint or obsolete; at the posterior angle a small distinct blotch; on the eighth segment a small marginal blotch, and on the ninth a transversal, curving, brown line; on the dorsal surface a small, short, curving, median, transversal brown line on the second segment, and a similar slightly larger one on the third segment; on segments 3–6 the broad transversal blotches of the ventral surface show through, as also do the chitinized parts of the genitalia; on the ventral surface there are median transversal brown markings as follows: on the first segment a small wide triangle, on the second segment a semiellipse with convex side forward, on segments 3–6 broad transverse blotches largest on segments 4–5; genitalia showing distinctly; one or two hairs at posterior angles of segments 1–7; segment 8 with a strong, long, hair and a shorter one on lateral margin; segment 9 with strong hairs arising from dorsal and ventral surfaces of the rounded posterior margin, in all about ten.

Nirmus hebes n. sp. (Plate v, fig. 3.)

A single poorly-preserved specimen from a Royal Tern, *Sterna maxima* (Bay of Monterey, California).

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Description. Body, length 1.72 mm., width .5 mm.; strongly marked, abdomen with large, lateral, transverse blotches and an uncolored longitudinal median line.

Head, length .47 mm., width .35 mm.; elongate conical, front truncate, bare (?); trabeculæ small but distinct; temporal margins subparallel, with one hair near posterior angle; antennal bands distinct, dark brown, bending inwards at the suture, and with posterior extremity expanded; temporal margins narrowly edged with dark brown; occipital bands indistinct, diverging, more strongly colored at base.

Prothorax with rounded angles, bare (?); posterior margin flatly convex, with colored lateral border. Metathorax with rounded anterior angles, diverging sides and obtuse posterior angles; angulated on abdomen; two or more hairs in posterior angles; lateral borders colored. Legs concolorous with body, with darker narrow margins. Sternal markings consisting of two pairs of intercoxal lines.

Abdomen elongate elliptical; posterior angles of posterior segments with short hairs; each of segments 2–7 with a marginal black blotch, widest anteriorly and projecting

Nirmus farallonii n. sp. (Plate v, fig. 4.)

A single female specimen taken from a Farallone Cormorant *Phalacrocorax dilophus albociliatus* (Bay of Monterey, Cal.) An immature specimen taken from a Western Grebe, *Colymbus septentrionalis* (Bay of Monterey, Cal.) is also probably of this species. It may be a straggler. In general marking and outline this new species resembles *Nirmus dispar* Piaget, taken by the namer on a *Carbo sulcirostris* from a skin in the Leyden Museum. *Dispar* is a much smaller species, and lacks the characteristic median abdominal blotches of *farallonii*.

Female. Body, length 2.66 mm., width .84; ground color pale clear brown; strongly and extensively marked with dark brown.

Head, length .6 mm., width .53 mm.; conical, narrow in front and rounding; five marginal hairs, a long one on dorsal surface between the front two and two shorter ones on dorsal surface near the fourth marginal; trabeculæ small and nearly obtuse; temporal margins rounding and with one long hair and several short prickles; occipital margin slightly concave; eyes prominent, with a very short prickle; antennæ short, second segment longest, third and fourth about equal, fifth longer, concolorous with pale ground color of head; clypeal signature distinct, short pentagonal, with hinder margins and posterior angle rounded; whole head, except small parts of clypeus, pale brown; antennal bands broad, distinct, bending in at suture; small black ocular flecks, and converging occipital bands.

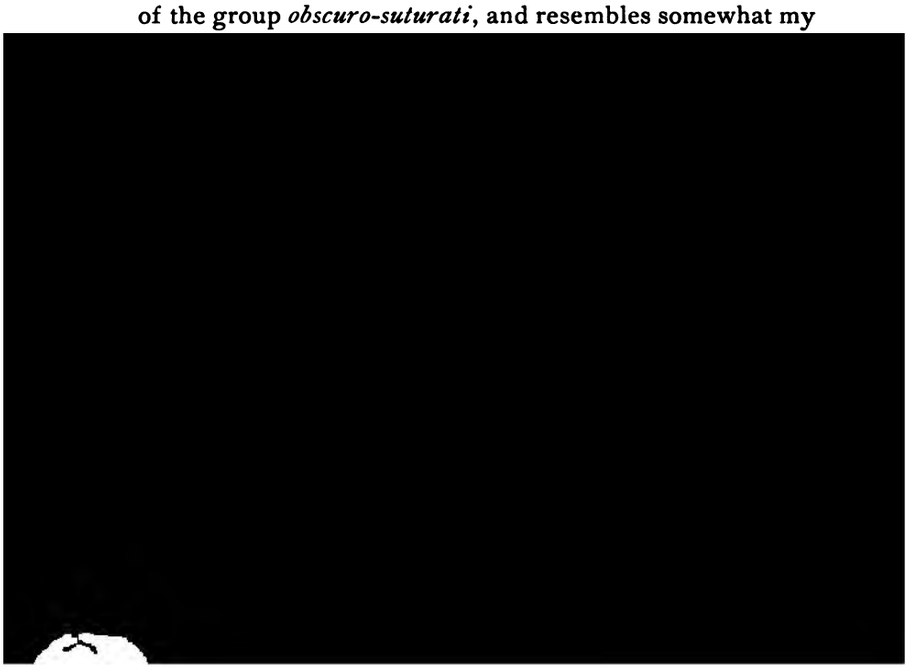
Prothorax shorter than broad, quadrangular with rounding angles; one long hair and one short thorny hair at posterior angle; color brown, with darker lateral bands which expand into triangular dark brown blotches in posterior angles. Metathorax broader than long, quad-

rangular with lateral margins diverging slightly, and anterior angles distinctly expanding and tubercular in front of a constriction; posterior margin straight; posterior angles with one long and one short hair in point of angle, and near them five long hairs set in an elliptical clear space; brown, palest in center, lateral bands very dark in posterior two-thirds, and bending in along anterior margin. Legs colored.

Abdomen elongate elliptical, with posterior angles projecting, and two or three rather long hairs in each angle; a few long hairs on dorsal surface; segment 1 all brown, others with strong, quadrangular, lateral, brown blotches, black on outer margin, and with uncolored stigmatal spots and a median quadrangular light brown blotch; posterior angles uncolored; segments 8–9 undivided, but with distinct blotches and no median blotches; segment 9 rounding, hardly if at all emarginated, and with only a few short hairs.

Nirmus orarius n. sp. (Plate v, fig. 5.)

A single specimen from a Golden Plover, *Charadrius dominicus* (Lawrence, Kansas). This form is a member of the group *obscuro-suturati*, and resembles somewhat my



long hair; antennæ uncolored, short; clypeal signature uncolored; mandibles and labium brown, a narrow lateral brown margin along forehead interrupted in front of antennæ and at suture and along temples.

Prothorax markedly narrower than head; quadrangular, with sides converging slightly toward front; one hair in posterior angle; with brown marginal band distinct along posterior margin. Metathorax but little longer than prothorax, wider, with rapidly diverging lateral margins; posterior margin angulated; four long hairs in posterior angles, grouped in pairs, one pair being a short distance inward on posterior margin; an interrupted, lateral, brown band and a long, triangular, brown blotch projecting inwards from middle of lateral margin. Legs uncolored with weakly colored tarsi.

Abdomen elongate, with convex sides, not parallel; segments of about equal length; segment 9 short and with weak, rounding emargination on posterior margin; a few scattered weak hairs on surface, and segments 5–8 with one or two weak hairs in posterior angles; a narrow, lateral band emphatic in anterior part of each segment and margined outwardly by a narrow clear space; segments 1–6 with large, median, pale brown transverse blotch.

Nirmus giganticola n. sp. (Plate v, fig. 6.)

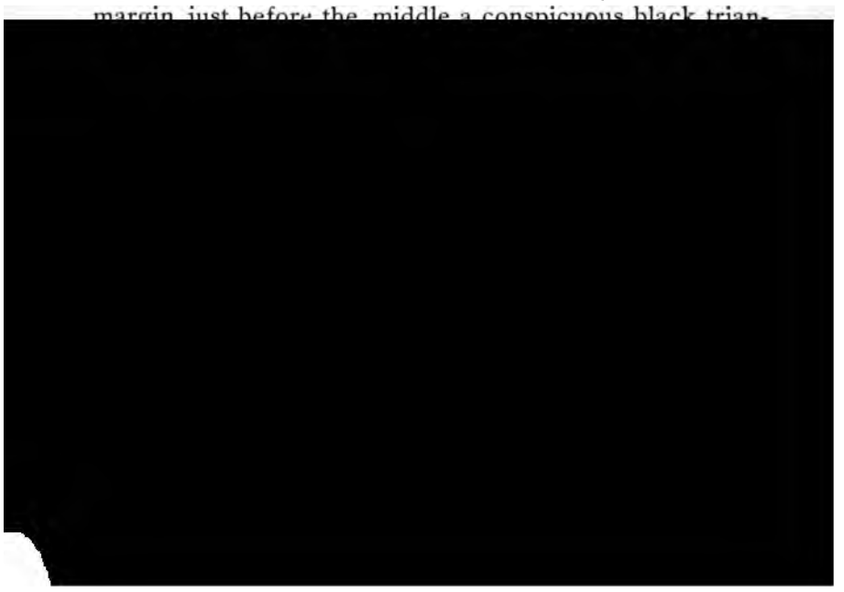
This well-marked *Nirmus* of the group *nigropicti* was taken from the Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). It was found on both of two birds of this species shot. I have not found it on any other bird-species.

Body, length 3.5 mm., width .87 mm.; white with a few definitely arranged black and brown spots; of about the average size and usual shape of the *Nirmi nigropicti;*

body with a few hairs on margins, general surface glabrous.

Description of male. Head, length .75 mm., width .62 mm.; conical, front produced and narrowly rounded, almost angulated; sides of forehead with five hairs, and one short one between the first two which rises on upper surface of clypeus at some distance from the margin; between second and third marginal hairs a short hair rising from surface of head so far inward that its tip does not project over the margin; temporal margins rounding, with few short hairs; occipital margin slightly and broadly concave; trabeculæ wanting; eyes distinct; antennæ with first and second joints longest, each as long as third and fourth, fifth longer than fourth, uncolored; clypeus uncolored; margins of forehead with a short, interrupted, dark brown line; an irregularly shaped dark brown orbital blotch; a small occipital signature; mandibles chestnut brown.

Prothorax rectangular, angles obtuse, glabrous, uncolored, with broad transparent margin. Metathorax trapezoidal, widest at posterior angles; lateral margins slightly concave, deepest before the middle; posterior margin weakly concave; a slender hair at each posterior angle, and in the angular area four long, strong hairs set closely together in a circular, uncolored spot; by each lateral margin just before the middle a conspicuous black trian-



hairs, eighth segment with two hairs at each anterior and posterior angle; ninth segment feebly angularly emarginated with one short stiff hair on each side of the emargination; lateral margins of abdomen transparent, containing entering whitish appendages of clear chitin, and on segments 2–7 a small distinct black blotch near the anterior angle of each segment; seventh segment also with a slightly curving, elongate, black fleck in the posterior angle; eighth segment marked like the seventh except that the posterior blotch is more narrowly linear; segment 9 with a narrow marginal blotch on each side.

Female generally similar to male; abdomen with one hair on posterior angle of first segment, two hairs on segments 2–4, three hairs on segments 5–7; segment 9 more acute than in male and two-pointed; segment 8 with linear blotch extending along whole length of margin; inside of lower end of this blotch and of marginal blotch of ninth segment a curving, linear, brown blotch; opening of vulva with nine stiff hairs on each margin.

This member of the *Nirmi nigropicti* differs markedly by the produced and narrowly rounded clypeus, the long metathorax with acuminate posterior margin, and the entire absence in both sexes of transverse blotches or lines on the abdomen from such forms as *punctatus*, *selliger*, and *lineolatus*, which in general appearance are somewhat similar to this new form.

Nirmus bœphilus n. sp. (Plate v, fig. 7.)

A single female taken from a Killdeer Plover, *Ægialitis vocifera* (Lawrence, Kansas). Packard's outline figure and incomplete description of *Lipeurus gracilis*, host? (Amer. Nat., 1870, vol. iv, p. 95, pl. i, fig. 6) must refer to a form resembling, in shape and markings, at least, this species. The new species belongs to the group *obscuro-suturati*.

Description of female. Body, length 1.95 mm., width .34 mm.; very elongate and slender, parallel-sided, pale with distinct brown marginal bands on head, thorax and abdomen, and with weakly colored and ill-defined transverse abdominal markings.

Head, length .48 mm., width .23 mm.; elongate, conical, with clypeus expanded, and obtusely angled in front and at sides; the expanded part of the clypeus is uncolored; one lateral hair on expanded clypeal portion, two in front of the suture (one rising from dorsal surface and one from ventral), one at the suture, and two rising from the ventral surface and projecting beyond the lateral margin behind the suture, and one long hair rising from the internal band and projecting beyond the lateral margin of the forehead; trabeculæ small but distinct, acute; temporal margins subparallel, with one long hair and one shorter hair; occipital margin concave; eyes inconspicuous; antennæ with second segment longest, fifth next, third next, fourth next, segment 1 short and thick, uncolored, except a faint brownish tinge on segment 5; clypeal signature triangular with apex toward the mandibles; entire lateral margin of head narrowly dark brown, interrupted at clypeal suture and emphasized at beginning of antennal band; uncolored occipital bands converging

dian, long, spear-head shaped sternal blotch of pale brown showing through. Legs with colored tarsi and strong claws.

Abdomen very long, slender, parallel sided, with few scattered long hairs on surface and in posterior angles of segments; segments 8–9 tapering posteriorly; segment 9 slightly but angularly emarginated, without terminal hairs on points; all segments with distinct narrow lateral brown bands, slightly expanding at front of each segment and projecting across the sutures; segment 1 with truncated, conical, paler, median blotch; other segments with indistinct, large, quadrangular, median blotches.

Nirmus punctatus Nitzsch. (Plate vi, figs 1 and 2.)

Germar's Mag. Entomol., 1818, vol. iii, p. 291.

Philopterus grammicus Gervais, Hist. Nat. Apteres, 1847, vol. iii, p. 350.

Nirmus punctatus Nitzsch. Nitzsch. (ed. Giebel) Zeitschr. f. ges Naturwiss., 1866, vol. xxviii, p. 377; Giebel, Insecta Epizoa, 1874, p. 176, pl. iv, figs. 1, 2; Piaget, Les Pediculines, 1880, p. 200, pl. xvi, fig. 4.

A female and two immature specimens taken from a Western Herring Gull, *Larus occidentalis* (Bay of Monterey, California). This species was found by Nitzsch on *Larus ridibundus*, and by Piaget on a *Larus dominicanus* from Chili, a *Larus crassirostris* from China, and a *Larus ichthyaëtus* from the Volgas; a well distributed form, surely. Piaget's figure omits the short hairs at the anterior angles of the clypeus present apparently in all *nigropicti*, and his description consistently with the drawing refers to but three hairs on each side of the clypeus, where there are really four. The specimen is much larger (length 2.4 mm.) than Piaget's seem to have been, the average length of his female specimens being 1.9 mm.

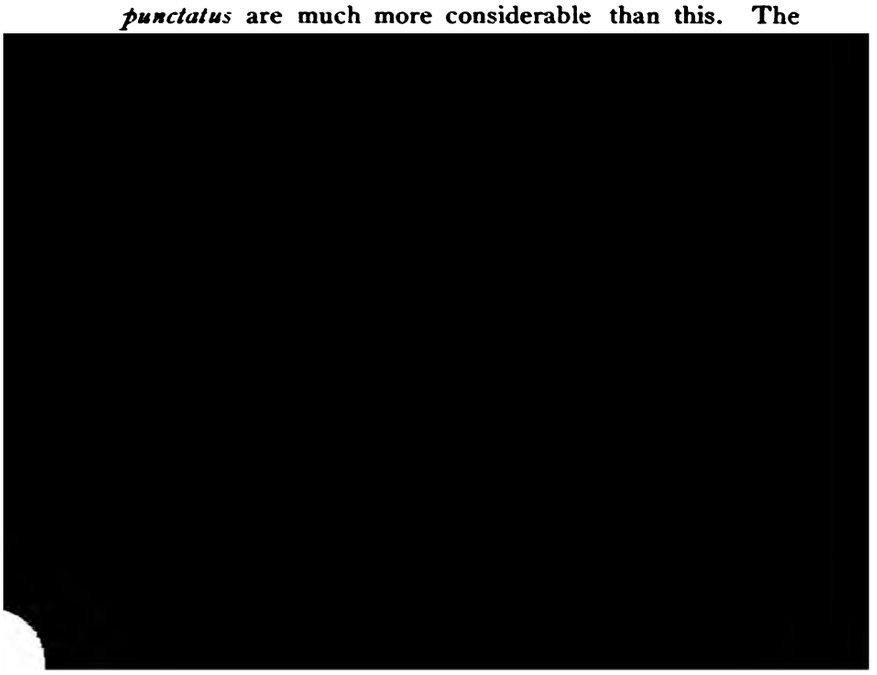
Description of young. Length, 1.5 mm., differing from adult specially in incompleteness of markings and relative

shortness of body. Head, length 5 mm., width .41 mm.; more rounding than truncate in front and without colored markings, except dark brown labium and pale brown mandibles; ratio of breadth to length greater than in adult. Thorax with a lateral small black blotch near anterior angle of metathorax. Abdomen, length .81 mm., width .41 mm.; without median markings, a small black blotch at anterior angle of segments 1–7, blotches growing smaller in each succeeding segment.

Nirmus felix Giebel. (Plate vi, figs. 3 and 4.)

Insecta Epizoa, 1874, p. 175.

Two specimens, both males, taken from two specimens of Heerman's Gull, *Larus heermani* (Bay of Monterey, California), may be attributed to this species of Giebel established on a single female taken from the same species of gull. Piaget (Les Pediculines, p. 201) assumes to believe Giebel's specimen a variety of *punctatus*. "Cette spèce ne me paraît non plus qu'une variété du *punctatus* où l'occiput n'est pas bordé de noir et les taches de l'abdomen sont plus allongées transversalement." But the differences between the males taken by me and the male *punctatus* are much more considerable than this. The



Head, length .53 mm., width .50 mm.; conical, clypeus truncate, even slightly concave in front, a short hair at each anterior angle and five other short hairs in the lateral margin between it and the small but distinct trabecula; temporal margin slightly rounding, with two longish hairs, and behind the hinder one two very short, stiff, prickle-like hairs; posterior margin straight; antennæ uncolored, second segment longest, third, fourth and fifth segments about equal; anterior part of clypeus transparent, and a transparent space on each side just inside of trabeculæ; margin of forehead with a twice-interrupted, uneven, black line, the middle third of it not contiguous to the margin and thickly crescentic; a black border along the temporal margins, bending inwards at anterior end; labium black; mandibles chestnut brown.

Prothorax quadrangular, bordered laterally with black, which runs inward along the posterior margin one-third the length of the margin; a single hair at posterior angles. Metathorax pentagonal, bordered on the anterior lateral margins with dark brown, inside of which the short, curving, black, intercoxal lines of the sternum show through; posterior lateral angles with five strong pustulated hairs almost exactly as in *præstans;* posterior margin angulated on abdomen; sternal markings consist of an obtusely-pointed, nipple-like fleck, projecting inwards from lateral margin of metathorax. Legs, femur with brown fleck at basal end and tibia with brown blotch at distal end, tarsus brown, otherwise white; tibia with three short, stiff hairs on inner side and one on outer side; femur with two or three short hairs arising in basal blotch.

Abdomen with segment 4 widest; nearly parallel-sided for most of its length; segment 1 with small black blotch at anterior angles, segments 2–7 with triangular (segments 2–3), or curving, angulated (segments 4–7) blotches

in anterior angles, with transparent spots at posterior angles and margins narrowly transparent; segment 8 with irregular black marginal blotch; segment 9 with two short chestnut lines parallel with posterior rounding margin; on dorsal surface of segments 2–6 a median transverse chestnut line shortest on second and on sixth segments, and with anterior border of each mark emarginated; ventral surface of segment 5 with broad transverse chestnut blotch almost divided in the middle; segments 4 and 6 with such blotches completely and widely divided, making two lateral blotches on each segment; segment 3 with faint indications of such lateral blotches; genitalia confined to segments 7–8, side pieces angulated with points projecting inwards and slightly crossing each other at tips; posterior angles of abdominal segments with few long hairs; segment 8 with hairs rising from middle of margin; segment 9 with about twelve hairs along posterior margin which is broadly rounded.

Nirmus signatus Piaget. (Plate vi, fig. 5.)

Les Pediculines, 1880, p. 186, pl. xv, fig. 8.

Nirmus signatus Piaget, König, Ein Beitrag zur Mallophagenfauna, 1884, p. 10.

Three males and three females taken from an American Avocet, *Recurvirostra americana* (Lawrence, Kansas). Piaget found this species common on *Recurvirostra ava-*

length 2.5 mm., width .62 mm.; head, length .56 mm., width .4 mm. The characteristic markings of the species, especially the large and sharply-defined signature, make it easily recognized.

Nirmus pileus Nitzsch. (Plate vi, fig. 6.)

Germar's Mag. Entomol., 1818, vol. iii, p. 291.

Nirmus pileus Nitzsch, Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 373; Giebel, Insecta Epizoa, 1874, p. 162; Piaget, Les Pediculines, 1880, p. 182, pl. xv, fig. 6.

A single specimen, female, taken from an American Avocet, *Recurvirostra americana* (Lawrence, Kansas). Nitzsch's and Piaget's specimens were taken on *Recurvirostra avocetta*. I figure the female, although Piaget's figure is excellent, for the convenience of American students. The measurements of the specimen are: Body, length 2.8 mm., width .78 mm.; head, length .62 mm., width .60 mm. These measurements vary a little from Piaget's, my specimen being shorter and wider, and the head a fifth greater in length and width.

Nirmus lineolatus Nitzsch. (Plate vi, figs. 7, 8 and 9.)

Zeitsch. f. ges. Naturwiss., 1866, vol. xxviii, p. 376 (ed. Giebel).

Nirmus ornatus Grube, v. Middendorff's sibir. Reise zool., vol. i, p. 477, pl. i, fig. 4.

Nirmus lineolatus Nitzsch, Burmeister, Handb. Entomol., 1838, vol. ii, p. 428; Giebel, Insecta Epizoa, 1874, p. 177; Piaget, Les Pediculines, 1880, p. 199.

I have taken this common *Nirmus* of the gulls from *Larus argentatus smithsonianus*, *brachyrhynchus*, *glaucescens*, *canus*, *vegæ*, *occidentalis*, *heermanni*, *californicus*, *delewarensis* (Bay of Monterey, California). Nitzsch found it on *Larus canus*, *argentatus*, *glaucus*, *tridactylus*, and Piaget on *argentatus* and *glaucus*. It is readily distinguishable by its characteristic head markings and by the ventral abdominal blotches and the genitalia of the male. The young, which I have found in many stages of growth,

differ from the adult, especially in the shape of the head and the markings of the body.

Description of very young. Body white, with few brown markings. Head short, broadly conical; front rounded; temporal angles with a single long hair; front with two very short hairs on each side (invisible except under high magnification); antennæ rather short and thick, uncolored; mandibles pale brown; a small black ocular fleck; head otherwise uncolored. Thorax shaped as in adult, with but four long metathoracic hairs instead of six; prothorax unmarked; a small fleck at anterior angle of metathorax. Abdomen with sides subparallel; no medial markings; a small lateral marginal blotch on segments 1–7; segments 1–4 without hairs at posterior angles.

Lipeurus densus n. sp. (Plate vii, figs. 1 and 2.)

A single female specimen taken from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). The form is a well-marked member of the group *circumfasciata*. As indicated by the clypeus, the simple lateral bands of the abdomen, and the concave posterior margin of the metathorax, it somewhat resembles *heterogrammicus* taken by Nitzsch and Piaget on *Perdix cinerea*.

Description of female. Body, length 4.3 mm., width .81 mm.; white, strongly marked with dark brown and

head, and continuing, interrupted at antennary fossæ, along temporal margins almost to occipital angles.

Prothorax quadrangular, convex on metathorax; two separated hairs at occipital angles; a lateral marginal brown blotch bounded outwardly along its posterior half by a transparent edge. Metathorax with lateral margins concave, deepest before the middle; anterior angles obliquely truncate; posterior margin straight or feebly concave; three long, strong, hairs in the posterior angles, arising from an elliptical uncolored space; a large brown blotch in anterior angles, and a smaller one in posterior angles, also a narrow marginal band running full length of segment. Sternal markings consisting of a faint bordering of anterior coxal cavities, an intercoxal line between pro- and mesacoxæ, an obscure median semicircular blotch with convex margin posteriorly, and a rather broad lateral marginal band on metathorax. Fore legs short, coxæ narrowly separated and globular, femora wide, tarsi alone colored; middle and hind legs long, coxæ produced widely and separated; femora long and slender; femora and tibiæ with dorsal, elongate, dark brown markings; tarsi and claws pale brown; tibiæ with two long hairs and three short ones on outer margin.

Abdomen with sides of segments 1–7 parallel; sides of segments 8–10 tapering posteriorly, tenth segment bicuspidate; posterior angles of segments 1–4 without hairs, angles of segments 5–6 with one hair, of segment 7 with three hairs, segment 8 with one hair rising before the angle, segment 9 with two hairs, segment 10 with each posterior point bearing four hairs, two arising on margin and one each from dorsal and ventral surfaces; a strong broad, dark brown, marginal band, this band projecting in on segment 9 almost to median line; segment 10 wholly colored.

Lipeurus varius n. sp. (Plate vii, figs. 3 and 4.)

A common parasite of the Pacific Fulmars, *Fulmarus glacialis* vars. *glupischa* and *rodgersii*, being found by me on twenty-six out of thirty specimens of these Fulmars shot on the Bay of Monterey, California. This white and blotched species belongs to the *Lipeuri circumfasciati*, and shows some similarity of appearance to *tricolor* Piaget (Les Pediculines, p. 363, pl. xxx, fig. 4), taken from an Albatross. Although this parasite was found on nearly all the Fulmars shot, on none was it present in large numbers (as was its companion *Lipeurus celer*), and among all the specimens taken by me, perhaps one hundred in total number, there is not a male.

Description of female. Body, length 2.9 mm., width .62 mm.; white, with distinct dark brown markings, marginal on head and thorax, and as lateral blotches not reaching the margins on abdomen.

Head, length .6 mm., width .4 mm.; sides subparallel, front parabolic, with five marginal hairs on forehead, one of which is separated from the others and close to angle of antennary fossa, and a short hair on dorsal surface projecting beyond the margin between first two mar-

posteriorly, anterior angles swollen, posterior margin straight, with four long hairs, not pustulated, in posterior angles; lateral margins unevenly bordered with black and dark brown, widest anteriorly; sternal blotch pale brown, anterior part elliptical, with a backward-projecting, long, slender, tapering process. Legs uncolored except for pale brown tarsi and claws.

Abdomen slightly widening to segment 6, and then more rapidly narrowing; white, with two lateral brown quadrangular blotches, fading inwardly, and each, except on segments 1 and 7–9, with uncolored stigmatal spot; these distinct and characteristic lateral blotches do not touch the lateral margin, the white marginal border varying from very narrow to one-half the width of the blotches, as in the specimen figured; ninth segment angularly emarginated with two hairs on each point.

I figure an immature specimen which is about one-half the size of an adult; it lacks entirely the abdominal markings, showing small portions, but intensely colored, of the thoracic and head markings. The presence of but one of the long metathoracic hairs is interesting, and the usual large head, characteristic of the immature stages, is noticeable.

Lipeuru celer n. sp. (Plate vii, figs. 5 and 6).

This large dark form was found in great numbers on all specimens except one of thirty Pacific Fulmars, *Fulmarus glacialis* vars. *glupischa* and *rodgersii* (Bay of Monterey, California), examined by me. It belongs to Taschenberg's group, *clypeati sutura indistincta*, and its most obvious resemblances are to *grandis* taken by Piaget on *Procellaria pelagica* in the Zoological Garden of Rotterdam. It is distinguished from *grandis* by the different form of the head, by lacking the occipital signature, by the presence of occipital bands, by the markedly different

abdominal markings, by the different character of the last segment of the male, and by other less obvious characters. Its dark color and large size make it a conspicuous object on the birds.

Description of female. Length 3.37 mm., width .7 mm.; body everywhere brown, the accentuated markings black, sides of head, thorax and abdomen subparallel.

Head, length 7. mm., width .5 mm.; sides nearly parallel; clypeus narrowly rounded in front with six lateral short hairs of which four are located along the margin at nearly equal distances apart, one arising from the dorsal surface near the anterior marginal hair, and one near the antennæ; trabeculæ wanting; temporal margins weakly convex with one long hair; antennæ with segments 1–2 about equal in length, segment 3 but little shorter, segments 4–5 shorter and feebly colored; whole head chestnut brown; clypeal signature wide anteriorly, short, and acuminate posteriorly; the pronounced antennal bands projecting inward at their basal extremities; the irregular orbital blotches, the narrow temporal marginal bands, and the distinct occipital bands much expanded at occipital margin, black or strongly dark brown.

rower and segment 9 very narrow and short; segment 1 shorter than the nearly equal segments 2–7; all segments brown; segments 1–7 with a rather broad, black, lateral, marginal blotch, emarginated on inner face; these blotches touching at the sutures produce a continuous lateral band emarginated on each segment; segment 8 not distinctly blotched, but with narrow lateral black margin; segment 9 slightly emarginated, and with a brown blotch on each side; segment 1 especially, and segment 2 with an ill-defined median blotch of dark brown; the sutures between segments 2–7 showing except at lateral ends as uncolored lines; below, the lateral bands are narrower and not emarginated (or faintly on each segment); segment 1 with distinct median blotch, and segment 2 with a larger indistinct blotch; one or two hairs at posterior angles of segments; on segments 7–9 more hairs.

Male. Body, length 3.44 mm., width .59 mm.; head, length .72 mm., width 5. mm. Antennæ, first joint as long as all others combined, second next longest, third short with a dorsal angular projection at distal extremity, fifth slightly longer than fourth; first, fourth and fifth more colored than others. Abdominal segments with complete transverse dark brown bands, black at lateral margins, and with paler stigmatal spots; ninth segment very small and not emarginated.

Rudow (Zeitschr. f. ges. Naturwiss., 1870, vol. xxxv, pp. 121–137), describes several *Lipeuri* taken on *Procellaria*, and one, *nigricans*, is a form as dark as *celer*, but all of these species are small, *nigricans* being but 1.5 mm. long.

Lipeurus longipilus n. sp. (Plate vii, fig. 7.)

A few males and females taken from two specimens (out of ten shot) of the American Coot, *Fulica americana*

(Monterey, California). The species was not present on any one of five Coots taken at Lawrence, Kansas. A well-marked member of the group *clypeati sutura distincta*.

Description of the male. Body, length 2.4 mm., width .4 mm.; fuliginous with paler femora, antennæ, prothorax and posterior half of abdomen, and black marginal bands on head, thorax and abdomen.

Head, length .53 mm., width .35 mm.; elongate, conical, with narrowly parabolic front, four marginal hairs in front of suture and three behind it; temporal margins with one hair, occipital margin straight or feebly concave; no trabeculæ; eyes inconspicuous; antennæ, first segment short, second segment large, broadest at base, almost as long as third, fourth and fifth together, third deeply notched and with an acute claw-like extremity, fourth and fifth short, cylindrical and more strongly colored than other segments; signature shield-shaped, extending to front margin of head, pale-colored anteriorly, with indistinct transverse striæ parallel with anterior margin, dark brown behind, a distinct suture extending from posterior angle along the median line not quite to the anterior mar-

lateral border of black, widest at constriction. Legs with dark colored coxæ and tibiæ, paler femora with darker markings.

Abdomen elongate, first segment much narrower than thorax at articulation, segments gradually widening to the fifth and narrowing from there to the ninth; segments 5–7 shorter than others; segments 1–2 with one hair at posterior angle, segment 3 with two hairs, and remaining segments with much longer hairs; distinct marginal black bands, with clear segmental spots; transversal dark brown bands, narrower on segments 5–7; ninth segment wholly colored and angularly emarginated, the points each with two short hairs.

Female. Body, length 2.65 mm., width .5 mm.; head, length, .55 mm., width .35 mm.; slightly larger than male; antennæ, second and fifth segments about equal, longest, third and fourth about equal; abdomen with segments gradually shortening from first backward through the seventh, eighth slightly longer, ninth deeply angularly emarginate, the two acute points without hairs; from the dorsal face of the eighth segment two very long hairs arise just inside of the black lateral band; all segments wholly colored except posterior half of the eighth; the transverse sutures uncolored, and indications of an uncolored median longitudinal line on segments 3–6; lateral marginal bands black, with clear stigmatal spots on inner margin.

Lipeurus picturatus n. sp. (Plate viii, figs. 1 and 2.)

Four specimens, all female, taken on two specimens of American Coot, *Fulica americana* (Monterey, California), out of ten shot. No specimens found on four Coots killed at Lawrence, Kansas. A finely-marked form, with indistinct suture.

Description of female. Body, length 2.1 mm., width .35 mm.; slender, parallel-sided, strongly marked with brown and black in regular blotches and bands.

Head, length .5 mm., width .32 mm.; elongate conical with narrowly rounding or parabolic front; a weakly projecting very obtuse angle at suture; six marginal hairs, of which four are grouped about this angle; trabeculæ small but distinct; temporal margins with one hair; occipital margin concave; antennæ uncolored; segments 1–4, beginning with 1, gradually shorter, fifth segment as long as second; signature broad, paler in front and with indistinct transverse striæ parallel with anterior margin, posterior margin concave, and with a broad, uncolored median line running from this border nearly to anterior margin; the signature is thus almost divided longitudinally; antennal bands black, extending anteriorly and fading into the paler color of the signature; temporal margins unevenly bordered with blackish, and bearing one hair; an acorn-shaped occipital signature indistinctly showing through from under surface.

Prothorax almost square, with posterior margin slightly angulated on the metathorax; clear smoky brown in mid-

entirely across, with narrow marginal black bands, and two quadrangular smoky brown blotches separated from each other and from lateral band by uncolored spaces.

In an immature specimen (plate viii, fig. 2) of about same size as adults, the markings are less intensely colored, the occipital signature and precoxal lines of ventral surface showing through, and the segmental parts of the marginal abdominal bands distinct, so that each segment appears to have four blotches, the outer ones darker.

Lipeurus diversus n. sp. (Plate viii, figs. 3 and 4.)

Several specimens taken from the Black-vented Shearwater, *Puffinus opisthomelas* (Bay of Monterey, California). The species is very like, in outline and markings, Piaget's species *angusticeps* (Les Pediculines, p. 306, pl. xxv, fig. 4) from a *Thalassidroma leachi* (Zool. Garden of Rotterdam), but shows such marked difference in size and certain details that it must be looked on as a distinct species.

The measurements of the specimens are (following in parentheses are the corresponding dimensions of *angusticeps* as given by Piaget): Male, body, length 3.4 mm. (2.8 mm.), width .37 mm. (.30 mm.); head, length .7 mm. (.6 mm.), width .37 mm. (.28 mm.). Female, body, length 4.1 mm. (3.65 mm.), width .5 mm. (.46 mm.); head, length .72 mm. (.65 mm.), width .43 mm. (.37 mm.). The description of the species in general is that given for *angusticeps* differing as follows: Male, the posterior border of the signature angularly concave, not straight; the temporal margins with two short hairs instead of one; the antennal colored bands bending inwards at the clypeal suture and continuous with the internal bands which bound the oral fossa; the metathorax with five long hairs on posterior angles instead of two; the

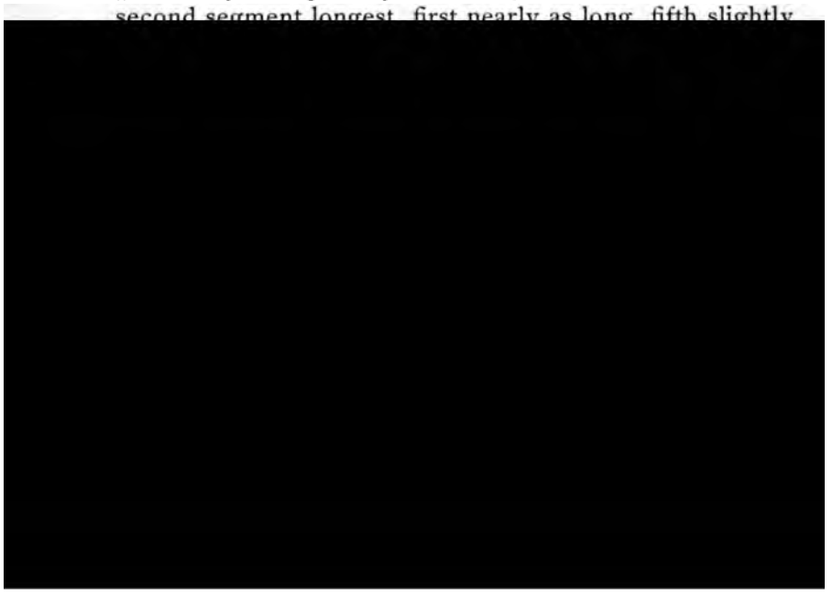
legs concolorous with the pale body color, not strongly colored; the last two segments of the abdomen not, as in *angusticeps*, with straight tapering sides bearing six short hairs and the last segment emarginated, but with convex margins with two or three rather long hairs, and the last segment very finely if at all emarginated. Female, the last segment of the abdomen not "*profondément entaillé*," but slightly and narrowly emarginated; also no median uncolored line on the first two segments.

Lipeurus limitatus n. sp. (Plate viii, figs. 5 and 6).

Three females taken from a Dark-bodied Shearwater, *Puffinus griseus* (Bay of Monterey, California). This species belongs to the group *clypeati sutura indistincta*, and is the first *Lipeurus* to be found on *Puffinus*.

Description of female. Body, length 2.75 mm., width .41 mm.; slender, parallel-sided, pale with light yellowish brown well defined markings.

Head, length .6 mm., width 4. mm.; elongate, conical, front rounded, with four short marginal hairs, one on dorsal surface between first and second marginal hairs, and one very short hair at antennal angle; trabeculæ wanting; temporal margins with one hair; occipital margin nearly straight; eyes inconspicuous; antennæ with second segment longest, first nearly as long, fifth slightly



gins short and hardly distinct from lateral margins; lateral margins narrowly darker colored than rest of segment; no hairs. Metathorax almost three times as long as prothorax; sides subparallel; hind margin feebly convex or slightly angulated on abdomen; with four long hairs and one short one in posterior angles, the short hair being next to the outermost hair; the lateral margins very narrowly darker edged along their hinder half. Legs concolorous with body, dorsally narrowly darker edged.

Abdomen slender elongate, subparallel-sided, growing slightly wider to segment 7, segments 8–10 tapering; segments 1–7 subequal in length, segment 8 half as long as segment 7, segment 9 shorter than segment 8; segment 10 obtusely two-pointed; very sparsely haired, segments 2–6 with one short hair on margin just in front of posterior angle; a square pale brown blotch on each side of segments 1–7, darker-edged outwardly, and separated by a distinct median uncolored line; blotches of segment 8 meeting, and the markings of segment 9 continuous.

Lipeurus constrictus n. sp. (Plate viii, figs. 7 and 8.)

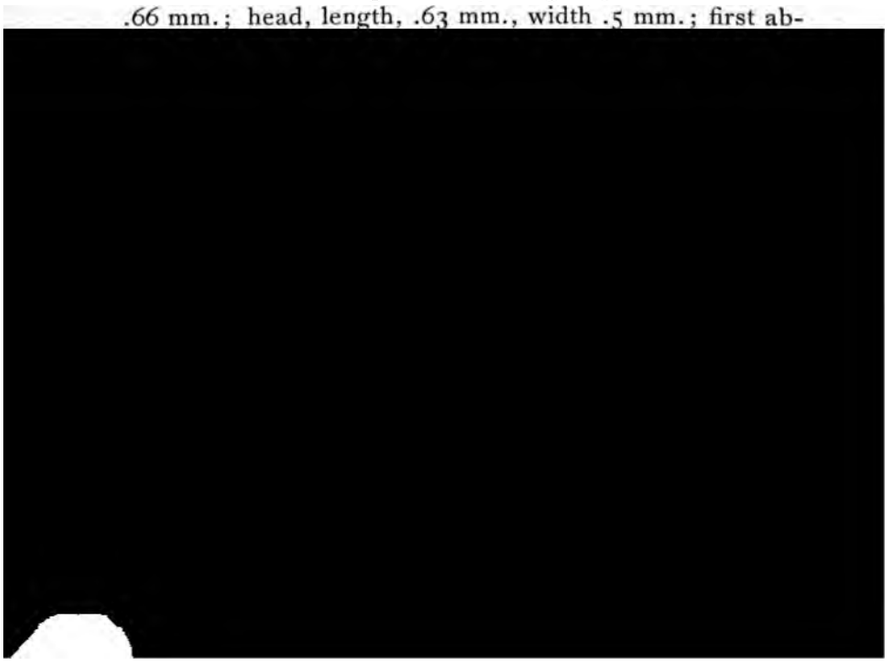
Found on three out of six specimens of the Surf Scoter, *Oidemia perspicillata*, and on one out of six specimens of the White-winged Scoter, *Oidemia deglandi* (Bay of Monterey, California); also found on a specimen of *perspicillata* taken at Lawrence, Kansas (Kansas River, during migration). The new form belongs to the group *bisetosi*, and is distinguished from *squalidus*, the member of the group which the new form most resembles by the smaller size, by the narrow basal abdominal segments, and by the concave hinder margin of the clypeal signature. Many specimens, males, females and young were taken.

Description of the male. Body, length, 2.31 mm., width 5 mm.; general habitus of *squalidus*, but distinctly

smaller and with waist-like narrow basal abdominal segments.

Head, length .53 mm., width .41 mm.; temporal margins with five very short stiff hairs or prickles and one longer hair; antennal bands most strongly marked at anterior end, ocular blotch dark brown, and temporal margin broadly banded with brown paling internally. Lateral bands of prothorax darkest at posterior angles. Metathorax with large, lateral, marginal, dark brown blotch in front of the middle, and margin behind the blotch dark brown; hairs seven, as in *squalidus*. Legs concolorous with body, tarsi and claws darker. First two abdominal segments much narrower than succeeding ones, segments 4–5 the widest; segments 3–6 with two hairs, a long one and a short one, at posterior angles; segment 9 feebly emarginated, thus obtusely two-pointed; segment 1 short, segments 2–3 longest and equal, segments 4–5 next longest and equal, segment 6 very short especially in middle, segments 7–8 equal; lateral marginal bands distinct, dark brown; within pale yellowish brown quadrangular blotches separated by uncolored median line on segments 2–4.

The female is larger; body, length 3.12 mm., width .66 mm.; head, length, .63 mm., width .5 mm.; first ab-



Lipeurus ferox Giebel. (Plate ix, figs. 1 and 2.)

Zeitsch. f. ges. Naturwiss., 1867, xxix, p. 195.

Pediculus diomedæ. Fabr. Ent. Syst., 1794, iv, p. 421.

Lipeurus diomedæ Dufour. Ann. Soc. Ent. France, 1834, iv, p. 669, figs. 1 and 2; Giglioli, Quart. Jour. Mic. Sci., 1864, iv, N. S., p. 19, plate i, b, figs. 1, 2.

Lipeurus pederiformis Dufour. Ann. Soc. Ent. France, 1834, iv, p. 676, pl. 26, fig. 4.

Lipeurus ferox Giebel. Insecta Epizoa, 1874, p. 235. Piaget, E. Les Pediculines, 1880, p. 333. Taschenberg, O., Die Mallophagen, 1882, p. 145, pl. v, figs. 1, 1a.

To this large and striking species may be attributed three specimens, one male and two females, taken from the Short-tailed Albatros, *Diomedea albatrus*. The male was taken from one bird, the two females from another; these two birds, both immature, were the only specimens of this bird species taken on the Bay of Monterey. The various descriptions of *ferox* by Giglioli, Giebel, and Taschenberg differ somewhat; Giebel had only a male before him; Taschenberg had in addition an immature female, and while Giglioli had both sexes his descriptions are incomplete.

Description of female. Body, length 9. mm., tapering from sixth abdominal segment abruptly to tip of abdomen, and gradually toward the head; strongly and distinctly marked with dark brown on both sides of the body for its whole length; a median uncolored line widest on head and on sixth abdominal segment; body nearly glabrous.

Head, length 2.1 mm., width 1.4 mm.; widest behind the eyes; margins of head in front of antennæ nearly straight and oblique; temporal margin feebly rounding; occipital margin weakly concave; clypeal suture distinct; clypeus convex in front, without hairs or bristles: at suture a slight rounded emargination, with one long hair, and behind it five short hairs, farther back one short hair, and in front of insertion of antennæ two short hairs; sig-

by Taschenberg which distinguishes this species from the otherwise similar form *bifasciatus* Piaget, found on *Pelecanus crispus* (Zool. Garden of Rotterdam).

I figure both sexes, although Taschenberg's figure of the male is good. I figure also two stages of the young. The measurements of the specimens figured are as follows: Male, body, length 2.6 mm., width .62 mm.; head, length .52 mm., width .5 mm. Female, body, length 2.7 mm., width .9 mm.; head, length .56 mm., width .56 mm. Young female, body, length 2.28 mm., width .72 mm.; head, length .5 mm., width .48 mm. Very young, body, length 1. mm., width .44 mm.; head, length .375 mm., width .44 mm.

Lipeurus temporalis Nitzsch. (Plate x, fig. 1.)

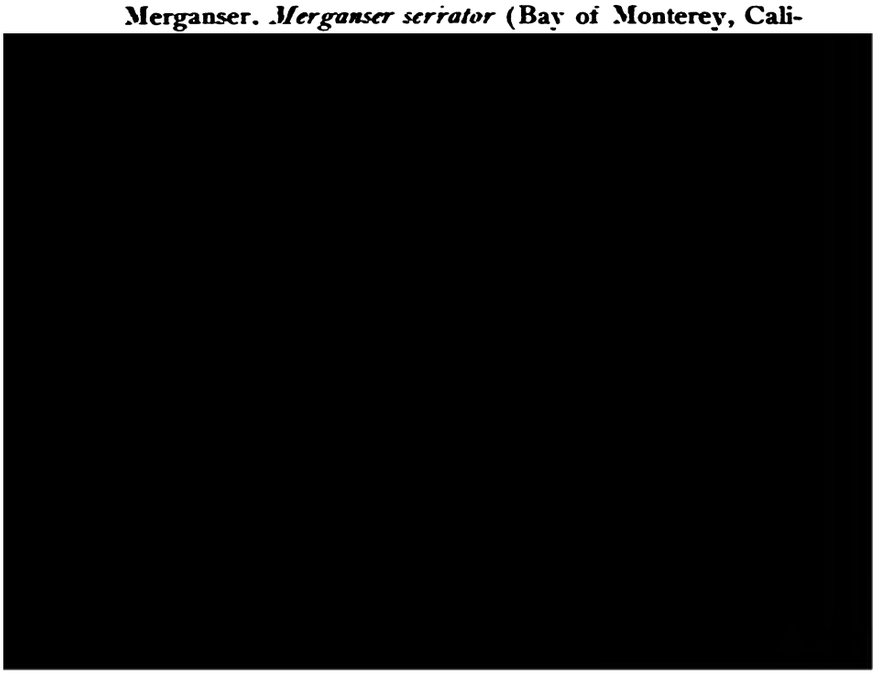
Germar's Mag. Entomol., 1818, vol. iii, p. 292.

Ricinus mergi serrati De Geer, Mem. pour servir a l'hist. des Insectes, 1778, vol. vii, p. 78, pl. iv, fig. 13.

Pediculus mergi Fabricius, Species Insectorum, 1781, vol. ii, p. 480.

Lipeurus temporalis Nitzsch. Denny, Monograph. Anoplur. Brit., 1842, p. 175, pl. xiv, fig. 7; Giebel, Insecta Epizoa, 1874, p. 239; Piaget, Les Pediculines, 1880, p. 350, pl. xxxi, fig. 1.

Two females and a male taken from a Red-breasted Merganser. *Merganser serrator* (Bay of Monterey, Cali-



specimens, females only, were taken from *Procellaria capensis* (locality ?).

My adult specimens (three females) differ from Taschenberg's description in these details: the eye has a small hair not mentioned by Taschenberg; the front angles of the antennary fossæ are prolonged into small but distinct trabeculæ; there are five long hairs, not four, in the posterior angles of the metathorax, four hairs rising near together in a clear space and the fifth apart and near the lateral margin. I find distinctly in undoubted adult specimens the ten abdominal segments referred to by Taschenberg, who thought his specimens might be immature. The measurements agree well, those of the adult female figured by me being: body, length 2.50 mm., width .56 mm.; head, length .75 mm., width .53 mm. I figure an adult female and a very young.

Lipeurus toxoceros Nitzsch. (Plate x, figs. 3 and 5.)

Zeitschr. f. ges. Naturwiss. (ed. Giebel), 1866, vol. xxviii, p. 386.

Lipeurus toxoceros Nitzsch. Giebel, Insecta Epizoa, 1874, p. 237; Piaget, Les Pediculines, 1880, p. 343; Taschenberg, Die Mallophagen, 1882, p. 149, pl. iv, fig. 7.

Lipeurus gyroceros Nitzsch (ed. Giebel), Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 386.

An adult male and two young taken on two specimens of Farallone Shag, *Phalacrocorax dilophus albociliatus* (Bay of Monterey, California), and one adult male from a California Brown Pelican, *Pelecanus californicus* (Bay of Monterey, California). The pelicans and cormorants congregate in great numbers on the same rocks in Monterey Bay, and it is not surprising to find a straggling individual of this cormorant parasite on a pelican. Nitzsch's specimen was collected on a *Halieus carbo*, and the specimen described by Nitzsch as *gyroceros*, but declared by Taschenberg to be identical with *toxoceros*, was found on *Halicus braziliensis*.

The adult male figured by me measured as follows: body, length 3. mm., width .8 mm.; head, length .62 mm., width .6 mm.; and the young as follows: body, length 1.9 mm., width .53 mm.; head, length .5 mm., width .5 mm.

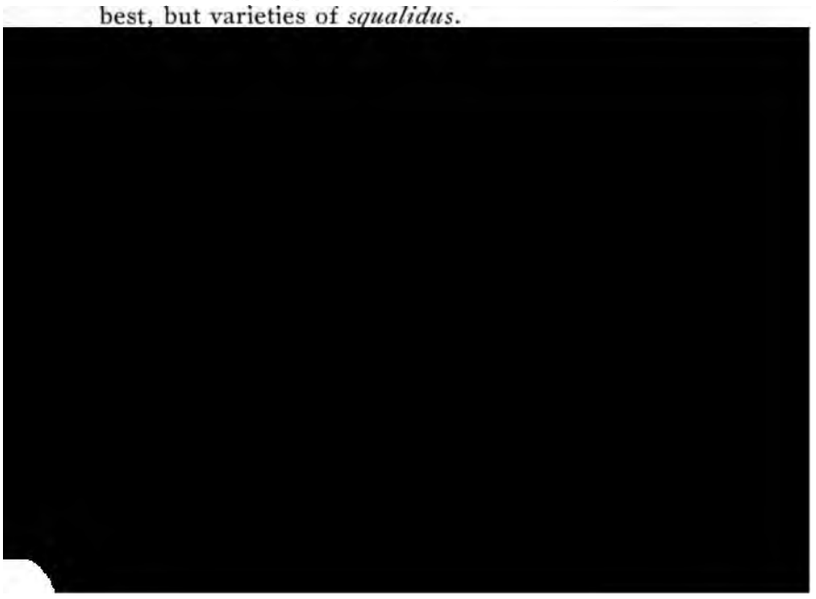
Lipeurus squalidus Nitzsch. (Plate x, figs. 6 and 7.)

Germar's Mag. Entomol., 1818, vol. iii, p. 292.

Pediculus anatis Fabricius, Systema Entomologiæ, 1775, p. 345.

Lipeurus squalidus Nitzsch. Gurlt, in Mag. f. d. ges. Thierheilk., 1842, vol. viii, p. 425; Denny, Monographia Anoplurorum Britanniæ, 1842, p. 176, pl. xiv, fig. 5; Grube, Middendorff's Reise, 1859, vol. ii, p. 486; Nitzsch (ed. Giebel), Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 385; Giebel, Insecta Epizoa, 1874, p. 241, pl. xvi, fig. 1; Piaget, Les Pediculines, 1880, p. 344, pl. xxx, fig. 5; Taschenberg, Die Mallophagen, 1882, p. 162.

This common species of the ducks has long been known, and is widely distributed geographically and zoologically. It has been taken on at least a dozen species of ducks, and what have been called varieties of it on still other species. The exact defining of *squalidus* has not yet been accomplished. Piaget declares that four resembling species (*sordidus*, *depuratus*, *frater* and *gracilis*) of Nitzsch and Giebel are simply *squalidus;* Taschenberg agrees with Piaget, and adds that Rudow's species, *rubromaculatus*, *punctulatus*, *cinereus* and *nyrocæ*, are, at best, but varieties of *squalidus*.



tion of the species, without attempting, as yet, to indicate varieties by name.

I attribute to this species specimens taken from a Bufflehead, *Charitonetta albeola*, Mallard, *Anas bosca*, and a Ruddy Duck, *Erismatura rubida*, all from Lawrence, Kansas. These specimens vary somewhat among each other, and all from the descriptions of Giebel and Piaget, which descriptions in turn do not agree with each other. The markings of the abdomen seem to be extremely variable, ranging from an indistinct lateral brownish coloration to distinct quadrangular, sharply-emarginated lateral blotches. More striking is the variation in number of the long hairs in the posterior angles of the metathorax. Piaget mentions two short ones, Giebel four, while all of my specimens show seven, varying in length and arranged as shown in figure 7, plate x. The specimen which I figure was taken from a Bufflehead, *Charitonetta albeola*, and will serve as a fairly representative illustration of the species for purposes of comparison. The measurements of this specimen are: body, length 3.3 mm., width .62 mm.; head, length .63 mm., width .44 mm.

Oncophorus advena n. sp. (Plate xi, figs. 1 and 2.)

A male and one female taken from the American Coot, *Fulica americana* (Bay of Monterey, California), and a male taken from a Pacific Loon, *Urinator pacificus* (Bay of Monterey, California). Can this last individual be a straggler? The female resembles the female of *Oncophorus minutus* Piaget, and was by me thought to belong to this species until I had found the male, whose appendaged antennæ make it impossible to refer the American specimens to this species. The female also on closer examination differs from the female *minutus* in its distinctly broader abdomen, by possessing four hairs on posterior

angles and margin of metathorax instead of two, and by the absence of an uncolored median abdominal line. The new species by the character of the antennæ of the male belongs to the group *docophoroides*.

The genus *Oncophorus* was established by Rudow (Zeitschr. f. ges. Naturwiss., 1870, vol. xxxv, p. 175) for his *Oncophorus schillingi* since removed by Taschenberg to his genus *Eurymetopus*. Piaget has preserved the generic name *Oncophorus* but applies it to a group of widely removed *Nirmus*-like small forms. Eight species have been described, of which seven are found on wading birds. Piaget says of the genus that it serves as a natural transition between the genera *Docophorus* and *Nirmus* on one side, and *Goniodes* and *Lipeurus* on the other.

Description of the male. Body, length 1.15 mm., width .4 mm.; small, pale with dark brown lateral abdominal bands on all except last three abdominal segments.

Head, length .34 mm., width .32 mm.; front parabolic with a few short hairs rising from the dorsal surface on each side of the middle of the front projecting over the margin; trabeculæ short, wide at base appearing equilaterally triangular in shape; antennæ with first segment

Prothorax, subquadrangular with anterior end projecting beneath the head, and anterior margin emarginated, posterior margin weakly convex; a long, strong hair in each posterior angle; pale golden, anterior angles darker. Metathorax not longer than prothorax, wider, with lateral angles rounded and with two long hairs inserted very closely together; on the posterior margin on each side two long hairs inserted very closely together; posterior margin convex and obtusely angulated on the abdomen; pale golden brown, with darker spots on anterior margin near the anterior angles. Legs concolorous with body, or slightly paler.

Abdomen short with subparallel sides, posterior angles projecting slightly, and with two or three rather long hairs; a double longitudinal line of weak hairs along dorsi-meson; lateral bands smoky brown fading out on posterior segments; last segment truncate behind, with a few very short inconspicuous hairs on posterior margin; genitalia distinct, with two backward projecting prongs and two longer forward projecting prongs reaching fourth segment.

Female, body, length 1.28 mm., width .5 mm.; head, length .4 mm., width .4 mm.; head less "square" in appearance, more tapering, temporal margins convex not straight; antennæ with second segment longest, third and fourth equal and fifth slightly longer than fourth; lateral bands of abdomen much more strongly marked and posterior angles of abdominal segments projecting more; last segment of abdomen rounding with slight emargination.

Eurymetopus taurus Nitzsch. (Plate xi, figs. 3, 4, 5 and 6.)

Zeitsch. f. ges. Naturwiss., 1866, vol. xxviii, p. 385 (ed. Giebel).

Philopterus brevis Dufour, Ann. d. l. Soc. Ent. France, 1835, vol. iv, p. 674, pl. xxxi, fig. 3.

Docophoroides brevis Giglioli, Quart. Jour. Mic. Science, 1846, vol. iv, p. 18, pl. i, B, figs. 3, 4.

Lipeurus taurus Nitzsch, Giebel, Insecta Epizoa, 1874, p. 234; Piaget, Les Pediculines, 1880, p. 332, pl. xxxi, fig. 3.

Eurymetopus taurus Nitzsch, Taschenberg, Die Mallophagen, 1882, p. 183, pl. v, figs. 8, 8a.

Many specimens, males, females and young, taken from two specimens of the Short-tailed Albatross, *Diomedea albatrus*, shot on the Bay of Monterey, California. Also found on two out of thirty specimens of the Pacific Fulmar, *Fulmarus glacialis* vars. *rodgersii* and *glupischa*, taken in the Bay of Monterey, California. This species has been found by Nitzsch, Swinhoe, Dufour and Meyer on *Diomedea nigripes*, *exulans* and *brachyura*. The specimens taken by me differ in some slight details from Taschenberg's careful description, notably in the longer and narrower signature and in their much smaller size, both males and females being less than three-fourths as large as the specimens (Nitzsch's) measured by Taschenberg, and about three-fourths the size of Piaget's specimens. The measurements of my figured specimens, as compared with Taschenberg's measurements, are as follows (Taschenberg's figures in parentheses): Male, body, length 2.12 mm. (4.12 mm.), width 1.18 mm. (1.75 mm.);

ones, I incline to attribute my specimens to Nitzsch's species rather than to call them new.

The blotches on the ventral side of the abdomen of the male, described by Piaget and said by Taschenberg to be wanting on his specimens, are plainly present in mine. As both Piaget and Taschenberg figure the male, I figure the female, the head of the male, and an immature male and immature female. This last shows an interesting stage in the formation of the lateral abdominal blotches, there being two blotches on the lateral portion of each segment, which fuse to form the large blotch of the adult stage. The short round abdomen and peculiar marking of the head are also striking. The measurements of the young female figured are: body, length 2.15 mm., width 1.25 mm.; head, length .65 mm., width .8 mm. The immature but nearly grown male is as large as the adults.

GIEBELIA gen. nov.

By this name (given in honor of Prof. C. G. Giebel) I would designate a *Docophorus*-like form of which several specimens (males and females) of a single species were taken from specimens of the Black-vented Shearwater, *Puffinus opisthomelas*. The distinguishing characters of the new genus are its *Docophorus*-like form, with very short, broad, suborbicular abdomen (in the single species yet known six-sevenths as broad as long); size of body and shape of abdomen same in both sizes; large head; produced rectangular anterior angles of temporal margins with the large eye in the angle; antennæ arising in an antennal emargination; conspicuous trabeculæ, a transparent, semilunar, transversal, membranous flap or process on the forehead with, in the male, a conspicuous, angulated, lateral lobe projecting over the lateral margin of the forehead about midway between the trabeculæ and the

anterior angles of the clypeus, in the female barely produced beyond the margin; strong, obtusely toothed mandibles; labium with short but distinct apraglossæ with five short spines on tip of each; antennæ similar in both sexes; abdomen turbinated, with dark lateral bands and brown transverse bands.

Giebelia (nov. gen.) **mirabilis** n. sp. (Plate xi, figs. 7 and 8.)

Four males and five females taken from six out of seven individuals of the Black-vented Shearwater, *Puffinus opisthomelas*, shot on the Bay of Monterey, California. The only species of *Giebelia* yet found.

Description of the male. Body, length 1.28 mm., width .56 mm.; short, broad (abdomen six-sevenths as broad as long); pale ferrugineous with dark brown to black markings; abdomen with strongly colored lateral bands and paler transversal bands.

Head, length, .45 mm., width .45 mm.; front broad, truncate with very narrow uncolored margin; one short hair in anterior angle; on lateral margin in front of projecting transparent flap two short hairs; lateral projecting part of crescentic, transversal, transparent flap as long

bare; four dark brown pointed papilla-like processes projecting upwards from dorsal surface of head, one at basal extremity of each antennal band, and one on each side in front of mandible; signature broad extending to mandibles; antennal bands dark brown, angulated, paler along lateral margins of clypeus in front of the flap; mandibles large and strongly colored, forming a broad dark brown transversal line connecting the antennal bands; occipital bands distinct, dark brown, diverging, black at base and biramose; suborbicular occipital signature with two short divergent posterior projections indistinctly showing through from under surface.

Prothorax short, broad; anterior angles, lateral margin and posterior angles rounded; a single hair at posterior angles; a broad, distinct, dark brown, lateral border. Metathorax broad, with angulated lateral margin, a pustulated hair and spine in each angle, and five more hairs, some pustulated and longer than the others, unevenly spaced along the lateral part of convex posterior margin; anterior portion of lateral margin with broad, distinct, dark brown border, with strongly colored process projecting posteriorly into the segment. Sternal markings composed of angulated intercoxal lines between meso- and meta-legs, and two small oblong spots darkest at posterior end on sternum between middle legs. Legs concolorous with body with narrow darker margins, tibiæ with three, short, strong spurs on distal extremity opposed to tarsal claws.

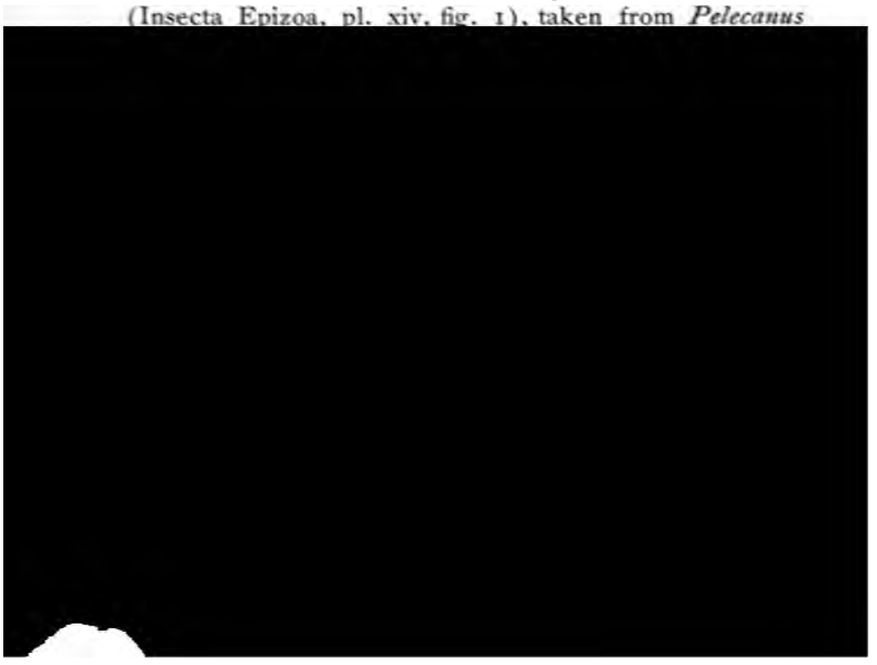
Abdomen short, broad, turbinated, with one or more hairs in each projecting posterior angle; a double row of short hairs down the middle of dorsal aspect; well defined, broad, black, lateral bands extending from segment 2 to segment 8, with uncolored stigmatal spots on inner margin of bands; a rather narrow, somewhat sinuous,

brown, transverse bar extending across each segment from lateral band to lateral band; last segment with uncolored anterior angles and broad median blotch; rounded behind with a few short hairs; genitalia extending forward into segment 6, and with most distinct posterior portion (in last two segments) cordate.

Female, length 1.43 mm., width .62 mm.; head, length .5 mm. width .5 mm.; lateral portion of transparent lobe of forehead barely projecting over lateral margin of head; lateral bands of abdomen broadest anteriorly, narrow with inward projecting linear appendages on posterior segments: transverse bands darker in medial portion; last segment broad, flatly rounded.

Colpocephalum unciferum n. sp. (Plate xii, figs. 1, 2 and 3.)

Found on one out of five specimens of the California Brown Pelican, *Pelecanus californicus* (Bay of Monterey, California); and on one out of two specimens of the American White Pelican, *Pelecanus erythrorhynchus* (Lawrence, Kansas). This well marked species shows a resemblance to Giebel's (Nitzsch's) figure of *C. excarenum* (Insecta Epizoa, pl. xiv, fig. 1), taken from *Pelecanus*



a weak hair, a short thick pointed spine, a shorter hair, two longer hairs, a shorter hair, and in the expansion in front of the ocular emargination four rather stiff longish bristles, the second being the longest; palpi just projecting beyond the margin, and antennæ projecting by all of the last segment which is diagonally truncated; the eye is inconspicuous but double, the anterior half being the more prominent; in the ocular emargination several hairs, and a fringe of short thick-set hairs extending back to the middle of the temporal margin; on the temporal margin several prominent hairs, of which two are very long; occipital margin concave, bare; two large, black, occipital triangles extending forward, and paling and tapering rapidly, as occipital bands; a broad occipital black border connecting the triangles; large, black, ocular blotches, and an uneven, curving, dark brown, inner band, running from the ocular blotches to the frontal margin, the anterior end of these bands expanded and darker.

Prothorax short, angularly elliptical, with a series of seven hairs along each lateral half of the posterior margin, beginning with a short spiny hair in the apex of the lateral angle; whole segment pale golden brown, with a paler narrow transversal blotch in front of the middle. Metathorax short, broad, trapezoidal, lateral margin with short spiny hairs; color pale brown, darker laterally. Legs long, femora thickened, tibiæ slender, expanding distally, especially the tibiæ of the forelegs; tarsi one-half as long as tibiæ; color pale golden brown, with dark brown markings on dorsal aspect of femur and tibiæ.

Abdomen elongate, widest at fourth segment and gradually narrowing in both directions; ends of segments projecting on the sides and armed with stiff, sharp-pointed hairs, especially in posterior angles; segments 6–9 with a pair each of very long hairs; ninth segment broad and

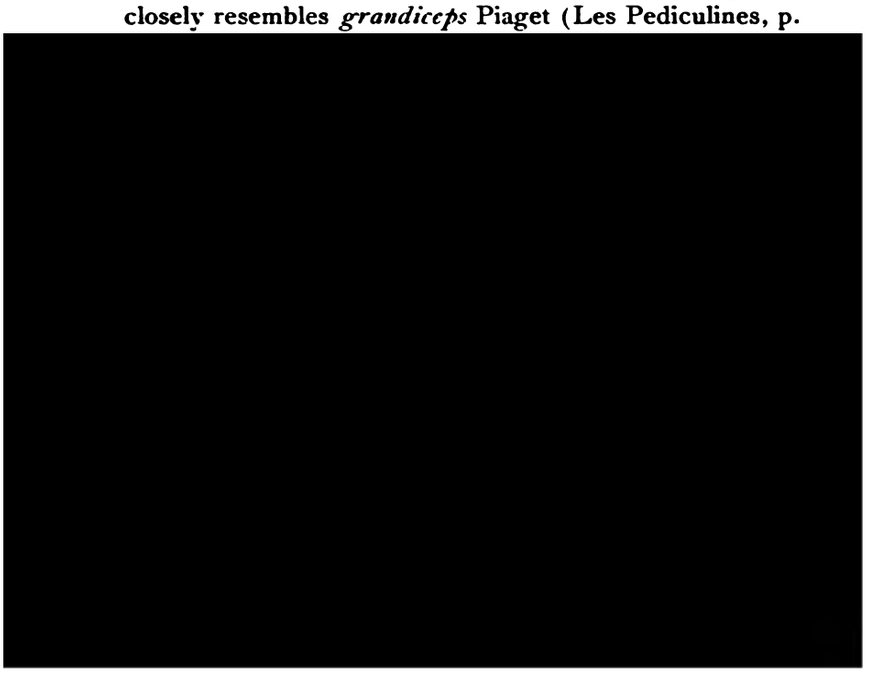
flatly rounded behind, posterior margin with several longish hairs; lateral ends of segments dark brown (dark region quadrangular) and a paler, transverse band running clear across each segment and covering all of its surface, paler in its median portion; sutures paler to uncolored.

Female, length 2.19 mm., width .62 mm.; abdomen rather fusiform in shape, segment 2 the widest; segment 9 elongate, tapering, with a series of six short, strong, recurved hooks on the front half of each lateral margin; posterior margin broadly obtusely angled and thickly beset with stiff hairs; from the middle of each lateral segmental margin arises a pair of long hairs; the lateral margins of the abdomen are darker, black in some specimens, than in the male.

An immature specimen, 1.56 mm. long, showed as its only markings the ocular blotches, the anterior ends of the inner bands and a short linear marking on occipital margin; all of these markings were distinct and black.

Colpocephalum uniforme n. sp. (Plate xii, fig. 4.)

A single female taken from an American Avocet, *Recurvirostra americana* (Lawrence, Kansas). This species closely resembles *grandiceps* Piaget (Les Pediculines, p.



circle, the contour being slightly irregular because of a small, medial, angled projection, and a shallow almost imperceptible concavity behind the slight but distinct, obtuse, anterior angles; four hairs between the medial frontal angle and the latero-anterior angle of which the last hair is the longest, a very short hair in the anterior angle and a hair just in front of the projecting palpus tip; four hairs, of which one is long, in the lateral angle in front of the ocular emargination; the eye large with a slight emargination, the front half projecting further than the posterior half; the hairs of the ocular fringe larger than usual, the fringe extending but slightly on the margin of the broad temporal region; temporal margin with three long hairs and several short ones; occipital margin concave, bare. Color of head pale golden brown, with small black ocular blotches and narrow black border on outer temporal and occipital margins; indistinct narrow brown occipital bands, the black occipital margin expanded at their bases.

Prothorax with a spine and long hair in produced lateral angles, and a number of long hairs in obtuse latero-posterior angles; the posterior margin seems to be bare; golden brown with small latero-anterior dark brown blotches and very narrow dark brown border between lateral and latero-posterior angles. Metathorax showing no marginal constriction at line of union of meso- and metathorax; sides bare; produced posterior angles with two long hairs and two stout spines; posterior margin straight, bare; whitish, with narrow dark brown to black lateral border expanded slightly in anterior angles. Legs concolorous with body with very narrow dark brown dorsal margins of femora.

Abdomen elongate with long hairs in posterior angle of segments, and short hairs along lateral margins; a nar-

row interrupted (by sutures) black marginal band, and faint golden brown, broad, transverse bands darker on posterior segments; last segment slowly tapering, broad and flatly convex behind, with transparent margin and fringe of fine sharp-pointed hairs.

The specimen is probably not adult, and the markings consequently less extensive than those of the adults.

Colpocephalum pingue n. sp. (Plate xii, fig. 5.)

Two males taken from one of the two specimens of the Short-tailed Albatross, *Diomedea albatrus*, shot on the Bay of Monterey, California. No *Colpocephalum* has hitherto been taken on an Albatross.

Description of male. Body, length 1.7 mm., width .62 mm.; short, broad, fuscous, with dark brown abdominal transverse bands, paler medially.

Head, length .28 mm., width .5 mm.; but little more than half as long as wide; front flatly rounding, with, on each side of the middle which is marked by a minute angular process, a short weak hair, a longer stiff spiny hair, then another similar one (adjacent to the projecting palpus), and on the lateral angle in front of the ocular emargination four hairs, of which two are the longest of the forehead hairs; the palpus and antenna projecting beyond margin, each by its last segment; the eye large, simple, filling the base of the ocular emargination and containing a distinct, divided, black fleck; the ocular fringe of hairs extending only to the posterior limit of the emargination; the temporal margin convex and with eight hairs of which three are long; occipital margin weakly concave with two hairs on each side of the middle. Color of head fuscous with a narrow black occipital margin expanded at the bases of the faintly discernible occipital bands; the ocular blotches large, black, extending along

the posterior margin of the emargination as a narrow black border, and still more narrowly and unevenly margining the temporal region; the inner bands indistinct, chestnut brown.

Prothorax broad (three-fourths as broad as head), short, posterior border rounded with a series of seven strong hairs beginning in the apex of the lateral angle; color pale yellowish brown. Metathorax short, broad, expanding rapidly posteriorly, anterior angles rounded, posterior angles produced, acute, with a short spine and a strong, long hair which is the terminal one of a series ranged along the straight posterior margin of the segment; sides bare. Color of prothorax light brown with a narrow dark brown or black uneven marginal blotch and a broad and transverse band of fuscous. Legs concolorous with body, with dark fuscous markings.

Abdomen broadly ovate, posterior angles of segments slightly projecting with one or two strong hairs and adjacent short ones; a series of strong hairs along posterior margin of each segment, and numerous other shorter hairs; each segment except last with a lateral marginal curving black blotch produced inwardly; also a transverse fuscous band extending entirely across each segment paler medially and darker on segments 7 and 8; ninth segment large, broad, rounded behind, posterior margin with two pairs of strong hairs on each side of the middle, whole segment uniformly fuscous.

Colpocephalum timidum n. sp. (Plate xii, fig. 6.)

Two females from a Golden Plover, *Charadrius dominicus* Lawrence, Kansas. The new species resembles *ochraceum* Nitzsch (Germar's Mag. Entomol., 1818, vol. iii, p. 299), somewhat.

Description of female. Body, length 1.94 mm., width

.37 mm.; pale brown, with small black markings on head and thorax, and dark brown markings on abdomen.

Head, length .36 mm., width .53 mm.; palpi not projecting, antennæ slightly projecting; front bare; lateral margin in front of ocular depression with four hairs of which one is long; eye with slight but distinct emargination; ocular fringe distinct; temporal margin with four long hairs, of which one, the third, is very long, and a few short hairs; occipital margin concave; pale yellowish brown, with small dark brown to black ocular blotches, and narrow occipital border expanded at bases of the very faint occipital bands.

Prothorax, with spine and hair on lateral angles, and close to the angle on latero-posterior border a hair; in latero-posterior angles a single hair, and along rounded posterior margin two very short hairs and two longer ones; without dark markings, although the lateral angles and borders appear darker because of sternal markings showing through; also the median sternal blotch faintly showing through. Metathorax with angular emargination on sides showing line of fusion of meso- and metathorax; anterior angles rounded; sides bare; posterior angles with a spine and two strong hairs; anterior angles bordered with black; lateral margins unevenly bordered with brown in which there is on each side a short linear black mark cutting off the region of the posterior angles. Sternal markings consisting of a median blotch on prothorax, a paler and more indistinct large median blotch on metathorax, and dark intercoxal lines. Legs concolorous with body; all femora thickened.

Abdomen, nowhere strongly colored or marked; an uncolored longitudinal line running parallel with each lateral margin on segments 1–8; outside of this line on each segment an ill-defined fuscous blotch showing as its

most distinct portion a short transverse line, especially noticeable on segments 1–6; the posterior angles of the segments, which hardly project, bear each a long hair, a very few scattered small hairs on lateral margin; numerous short non-pustulated hairs scattered over the surface of the body; last segment pale with two longish lateral marginal hairs, and convex behind with a short fringe of fine transparent hairs.

Colpocephalum funebre n. sp.* (Plate xii, fig. 7).

Two females from two specimens of the Glaucous-winged Gull, *Larus glaucescens*, Bay of Monterey, California. This species resembles *fuscipes*.

Description of female. Body, length 3.1 mm., width 1.5 mm.; large with comparatively small head and thorax; dark brown, with black markings.

Head, length 5 mm., width .78 mm.; palpus barely or not at all projecting beyond margin of forehead; antenna projecting slightly; front flatly rounded with eleven hairs on each side between middle of front and ocular emargination, of those on the true front the second and fifth longer than the others and of those on the side one very long; ocular emargination deep, narrow; eye large, simple, hemispherical, the ocular fringe prominent; of the hairs on the temporal margin four are long; occipital margin not deeply concave, bare; color dark brown with a narrow black border extending more or less distinctly entirely around the head; on the sides of the forehead the border is broken into spots, and along the front it is sinuate and is narrowly margined in front by a pale, almost uncolored space; on each lateral region of the forehead there are three small circular uncolored spots from each of which arises a short hair; on under side of head, a distinct large occipital signature; narrow oc-

cipital bands bending outward anteriorly, and a narrow black line bounding the oral fossa.

Prothorax, narrow, short; lateral angles obtuse, produced, and with a spine and long hair; in latero-posterior angle a long hair, and in addition two posterior marginal hairs on each side of the middle; color dark brown with narrow black lateral border, and a very narrow transverse line across the segment in front of the middle. Metathorax, sides bare, posterior angles with two spines and a long hair; posterior margin with a few hairs; color dark brown with darker irregular broad lateral border and large trapezoidal median blotch (sternal marking showing through) limited to metathorax; a distinct paler-colored sutural line between meso- and metathorax, with slight angular emargination on the sides; mesothorax with a paler-colored narrow median line separating the dark quadrangular lateral blotches. Sternal markings consisting of a median irregularly octagonal blotch on prothorax, behind it a Y-shaped line running across mesothorax and connecting with a large pentagonal metathoracic blotch with apex directed anteriorly; in addition broad lateral and coxal borders. Legs long, fore femora greatly thickened, middle femora not so much so and hind femora

to the pale longitudinal line, and along anterior margin not quite to this line; broad transverse bands extending across each segment between the pale longitudinal lines; last segment with three blotches and rounded, hair-fringed posterior border.

Colpocephalum laticeps n. sp. (Plate xii, fig. 8.)

A single male specimen from an American Egret, *Ardea egretta* (Lawrence, Kansas). This small and well-marked species cannot be referred to any one of the *Colpocephali* described by Nitzsch from various species of *Ardea*.

Description of male. Body, length 1.72 mm., width .72 mm.; dark golden brown, abdomen with distinct dark fuscous transverse bands.

Head, length .31 mm., width .62 mm.; just twice as wide as long; front broadly rounded with hairs on each side of the middle, as follows: a very short one, another and another, all some distance apart, and in the lateral angle in front of the ocular emargination four, of which two are long; the eye undivided but with a faint medial emargination and with a single black fleck in it; the ocular fringe not extending on the temporal margin; this margin with several short, fine, stiff hairs and three unevenly long pustulated ones; also a long pustulated hair arising from nearly the center of the temporal region; occipital margin not deeply concave, with four hairs; color pale smoky brown, ocular blotch black, bordered irregularly with dark smoky brown which extends backwards as an indication of occipital bands and forward as a suggestion of inner bands; temporal margin narrowly bordered with blackish brown; occipital margin narrowly bordered with black, widest along middle third of head.

Prothorax comparatively long and narrow (the width is always greater than the length among the *Colpocephali*),

Trinoton luridum Nitzsch. (Plate xiii, fig. 4.)

Germar's Mag. Entomol., 1818, vol. iii, p. 300.

(Louse of the Teal) Redi, Experimenta circa gen. Insectorum, 1686, pl. xii (or x?); Albin, Nat. Hist. of Spiders and other curious insects, 1736, pl. 46 (or 48?).

Trinotum luridum Nitzsch. Burmeister, Handbuch. d. Entomologie, vol. ii, p. 441; Giebel, Insecta Epizoa, 1874, p. 258, pl. xviii, fig. 7.

Trinoton luridum Nitzsch. Denny, Monograph. Anoplur. Brit., 1842, p. 234, pl. xxii, fig. 2; Piaget, Les Pediculines, 1880, p. 591, pl. xlix, fig. 3.

Trinoton gracile Grube. Middendorff's Reise, vol. i, p. 494, pl. ii, figs. 6 and 6a.

Trinoton conspurcatum Nitzsch. Gurlt, in Mag. f. d. ges. Thierheilk., vol. viii, p. 430, pl. iv, fig. 15.

I have taken this common parasite of ducks from the Shoveler, *Spatula clypeata*, the Buff-breasted Merganser, *Merganser serrator*, the Greenwinged Teal, *Anas carolinensis*, the Pintail, *Dafila acuta*, the Mallard, *Anas boscas*, the Widgeon, *Anas americana* (Lawrence, Kansas), and from the Ruddy duck, *Erismatura rubida* (Monterey, California). There is, as has already been said by Piaget, a considerable variation in the individuals of this species, especially in the extent and intensity of the abdominal markings. It seems hardly worth while in the

An immature specimen taken from a Greenwinged Teal, *Anas carolinensis* (Lawrence, Kansas), is almost as large as the average adult, but is uniformly pale, faintly tinged with clear brownish, showing no markings except a distinct black ocular fleck and the brown mandibles. The dimensions of this specimen are: Body, length 4.5 mm., width 1.43 mm.; head, length .81 mm., width 1.28 mm.

Læmobothrium similis n. sp. (Plate xiv, figs. 1 and 2.)

A single specimen from an Eared Grebe, *Colymbus nigricollis californicus* (Lawrence, Kansas). This species is very like Piaget's *emarginatum* (Les Pediculines, 1880, p. 585, pl. xlviii, fig. 8), taken from *Gallinula hæmatopus* (Zool. Garden of Rotterdam), but lacks the occipital bands of the head, has more of the peculiar, short, flattened, stiff points on the front margin of the head, has a very differently shaped prothorax (if Piaget's descripiion and figure are accurate), lacks the strong markings of emargination, and is a slightly larger species. My specimen is probably not adult, but is of not earlier stage than the last nymphal one. Adult specimens will measure a little larger, and will be a little more strongly marked. This genus has not before been found on a pygopodous bird.

Female, body, length 4.4 mm., width .87 mm.; uncolored (weakly pale brownish) with narrow, sharp, brown markings on head and thorax.

Head, length 1. mm., width .78 mm.; ocular emargination slight, contraction of sides of head even with the mandibles strong, sides of forehead slightly converging; front with rounding emargination, angles rounding; on each side of the center of the emargination toward the angle are a short hair, a longer hair arising from ventral surface, two short flattened spines, and projecting over

the margin between them a hair arising from the dorsal surface, a long hair, a very short weak hair, and beyond the apex of the angle two flattened spines, the second one longer, and a long hair; the front half of the convex margin of the antennal fossa bears one very long hair and four shorter hairs, and the hinder half three weak, equal hairs arising close together and projecting backwards; the temporal margins bear two long hairs and more than a dozen short, equal ones; occipital margin concave; eyes double, inconspicuous; antennæ concealed in fossæ but showing through, fourth segment subglobular; labial palpi, with thick segments of about equal length, third and fourth segments with a short hair at anterior outward angle; mandibles pale brown with teeth dark brown; ocular flecks black; antennal fossæ rimmed with brown and a curved band, convex behind, across the head between middle points of antennary fossæ; a narrow, long, pale brown triangle projecting back from middle of transverse curving band just described; no occipital bands; in front of mandibles a rounding, pointed, crescent-shaped fossa, convex anteriorly.

Prothorax, subquadrangular, with a narrow anterior

of the combined segments; three longer hairs and seven short ones along the margin of the segment; two brown flecks on front margin, and the rounding anterior angles narrowly and weakly margined with brown. Legs, uncolored, except for pale brown at extremities of segments, and very narrow marginal lines; front margins of femora of middle and hind legs with four or five subequal prominent hairs and several very short ones.

Abdomen, parallel-sided for anterior half and then gradually tapering posteriorly; no marginal constrictions between segments; but one or two long hairs in each posterior angle; last segment with one strong long hair and one longer, weaker hair in each posterior angle and a series of six short, equal hairs along posterior margin; margin narrowly lined with pale, clear brownish, and within a parallel, narrow, uncolored line.

Læmobothrium atrum Nitzsch. (Plate xiv, fig. 3.)

Germar's Mag. Entomol., 1818, vol. iii, p. 302.

Pulex fulicæ Redi, Experimenta circa generationem Insectorum, 1686, pl. iv, fig. 1.

Læmobothrium nigrum Burmeister, Handbuch d. Entomologie, 1832, vol. ii, p. 442.

Læmobothrium atrum Nitzsch, Denny, Monograph. Anoplur. Brit., 1842, p. 240; Giebel, Insecta Epizoa, 1874, p. 253, pl. xviii, fig. 5; Piaget, Les Pediculines, p. 586.

A single specimen from an American Coot, *Fulica americana* (Monterey, California). The previously taken specimens have been found on *Fulica atra*, also probably one occurrence on *Podiceps rubricollis*. The descriptions vary somewhat and are incomplete, and Giebel's figure shows strange markings of head and thorax, but the large size and dark coloration of the entire body sufficiently identify the species. Giebel's measurements are far under those of my specimen, which are: body, length 8 mm., width 1.9 mm.; head, length 1.4 mm., width 1.17 mm.

Menopon navigans n. sp. (Plate xiv, figs. 4 and 5.)

Two males and a young female taken from a Short-tailed Albatross, *Diomedea albatrus* (Bay of Monterey, California). Piaget has found a *Menopon (affine*, Tijdschr. voor Ent., 1890, vol. xxxiii, p. 248, pl. x, fig. 3) on an Albatross *(Diomedea exulans*, a skin in the Leyden Museum), but my new species does not resemble *affine* particularly. *Affine* is a smaller species, with a head more than three-fifths as long as broad; the head of the new species is twice as wide as long.

Description of the male. Body, length 1.8 mm., width .75 mm.; head and thorax pale with dark brown markings; abdomen with large, brown, transverse bands, subparallel-sided; many long bending hairs.

Head, length .34 mm., width .66 mm.; semilunar, front with, on each side, three hairs (of which the second is not strictly marginal), then a very short prickle, then five hairs in front of the ocular region, of which three are long; palpi and antennæ projecting by the length of their terminal segments; temporal margin with two very long hairs, one half as long, two one-fourth as long, and a few short ones; occipital margin concave with four hairs on

those of abdomen, in front of which a narrow whitish space broadest medially. Legs concolorous with pale ground color of body, with hairs and thickened femora.

Abdomen oblong, with convex sides and ends, all the segments except 9 being of approximately equal width; especially long hairs in posterior angles and shorter hairs on surface; each segment except 9 with broad transverse brown band covering nearly whole surface of segment and darkest along posterior margin; lateral extremities of bands dark brown to black, forming narrow interrupted lateral bands; segment 9 wholly colored, paler than transverse bands, large, rounding with numerous long hairs.

Menopon indistinctum n. sp. Plate xiv, figs. 6 and 7.)

Two females taken from an American Avocet, *Recurvirostra americana* (Lawrence, Kansas). This species most clearly resemble *crocatum* Nitzsch (ed. Geibel, Zeitschr. f. ges. Naturwiss., 1866, vol. xxviii, p. 392), from a *Numenius arquata* and *Hæmatopus ostralegus* (Piaget), but there are differences quite as considerable as those which have been used by Giebel and Piaget to separate the various *Menopon* species found on the shore birds. *Crocatum*, *lutescens et. al.* ought, perhaps, to be grouped together as a single species with several varieties, as is done for *Docophorus communis*, the common *Docophorus* of the passerine birds. However I add this species from our Avocet to the group which must sometime be well revised. The noticeable differences between this new species and *crocatum* lie in the number and disposition of the hairs of the head and thorax. The species does not at all resemble Nitzsch's species from the European Avocet, *Recurvirostra avocetta (micrandum*, Zeitschr. f. ges. Naturwiss. ed. Giebel, 1866, vol. xxviii, p. 392), which has a thorax without hairs, and an abdomen with uncolored longitudinal lines.

Description of female. Body, length 1.80 mm., width .7 mm.

Head, length .28 mm., width .5 mm.; semilunar; twice as wide as long, front with two short hairs at the middle, and on each side in front of the ocular region two short hairs and a long one; palpi slightly projecting; ocular margin straight or very faintly concave; temporal margin with four long pustulated hairs and several short ones; occipital margin concave with one long pustulated hair on each side; head golden brown with fuscous clouding, occipital margin and ocular fleck black; curving line bounding inwardly the antennal region black inwardly shading into dark brown outwardly; a transversal line even with the mandibles and expanded at outer ends, dark brown.

Prothorax, seven-eighths as broad as head, lateral angles very obtusely rounded, almost truncate, with two spines and a long hair; behind the angle on latero-posterior side a spine, then two hairs, and on the straight posterior margin three hairs on each side of the middle; color smoky brown with a distinct transverse darker line in front of the middle and not reaching the lateral margins; outside of each end of this line a short, slightly curving, longitudinal, dark line; the latero-posterior sides narrowly edged with black. Metathorax just as wide as head, narrow

small pointed blotch with two diverging very small linear processes projecting anteriorly, the whole between strongly curving, inwardly produced intercoxal lines, on mesothorax; and a larger median blotch, truncate behind, convex before, with two small linear points near the posterior angles of median blotch, on metathorax; a smaller semilunar median blotch on first segment of abdomen is also apparaent; the blotches of metathorax and first abdominal segment are beset with numerous short pustulated hairs. Legs pale smoky brown, with darker markings.

Abdomen, elongate oval, posterior angles of segments 1–3 projecting a little; the others barely or not at all; a rather long hair and some shorter ones in each angle; also a series of hairs in small pustulations along the posterior margin of each segment; all segments with a broad, distinct, light fuscous, transverse band whose extreme outer margins are darker; the bands separated by wide, uncolored, sutural lines; last segment, broad, short, uncolored, posterior margin concave with a series of fine short hairs.

Menopon numerosum n. sp. (Plate xv, fig. 1.)

An abundant parasite of the Pacific Fulmars, *Fulmarus glacialis* vars. *glupischa* and *rodgersii*, taken on twenty-four out of thirty specimens shot on the Bay of Monterey, California.

Description of male. Body, length 1.44 mm., width .62 mm.; pale yellowish to reddish brown, with transverse abdominal bands, separated by broad, white, sutural bands.

Head, length .28 mm., width .50 mm.; front very obtusely but distinctly angled with two short hairs on each side of the median angle; three long hairs and three short ones before the slight ocular emargination; a sparsely set

ocular fringe of short stiff hairs, and in the temporal angles four long hairs and several short ones; occipital margin broadly and shallowly concave and with four hairs; dark brown ocular blotches, distinct black flecks in the eyes, and a narrow, dark brown, occipital border.

Prothorax with posterior margin broadly and evenly rounded with fourteen long hairs in a series extending from lateral angle to lateral angle; a narrow transverse line in front of the middle and a short longitudinal line at each end of the transverse line; the lateral angle regions slightly darker than rest of segment. Metathorax with diverging sides, straight or very flatly convex posterior margin; along the sides three short spines, of which the first two project upwards and the third outwards beyond the margin; in the posterior angles are two long hairs, then a short spine, and then a series of twelve long, strong hairs ranged along the posterior margin. Legs concolorous with body.

Abdomen elongate ovate, with long hairs in the posterior angles of segments and a series of long hairs along the posterior margin of each segment; ground color whitish showing in broad, transverse sutural bands; each segment with a pale reddish brown transverse band

Menopon infrequens n. sp. (Plate xv, fig. 5.)

A single female taken from a Glaucous-winged Gull, *Larus glaucescens* (Bay of Monterey, California).

Description of female. Body, length 2 mm., width .81 mm.; brown with chestnut, transverse abdominal bands, narrow black lateral bands, and broadly linear, diagonal, black, ocular blotches.

Head, length .31 mm., width .62 mm., thus being just twice as wide as long; brown with darker fuscous clouds; narrow black occipital margin; black ocular blotches in the form of diagonal bars; some indefinite pale to uncolored spaces, as in the posterior angles, along the front, and a more definite circular space containing a long hair and a spine on each side of the forehead just outside of the origin of the labial palpi; on the front four short hairs near the middle, and on the sides in front of the ocular region two short hairs and one longer but weak hair; temporal angles with three long hairs, one one-half as long and some shorter hairs; occipital margin with four pustulated hairs; on ventral aspect occipital bands showing, enclosing an orbicular occipital signature, with a series of five pustulated hairs along the lateral margins.

Prothorax, with fourteen long, pustulated hairs extending in series from lateral angle to lateral angle along the posterior margin, which in its middle third is almost straight; ground color of segment largely clouded with fuscous to dark brown, especially in lateral angle region, which is very narrowly margined with black; the usual transverse line in front of middle with curving longitudinal lines at the ends especially distinct. Metathorax with lateral emargination and dark brown sutural lines separating mesothorax; posterior margin straight, with a series of not very long hairs, and two or three hairs and a spine in the posterior angles; a fuscous transverse band across posterior half of

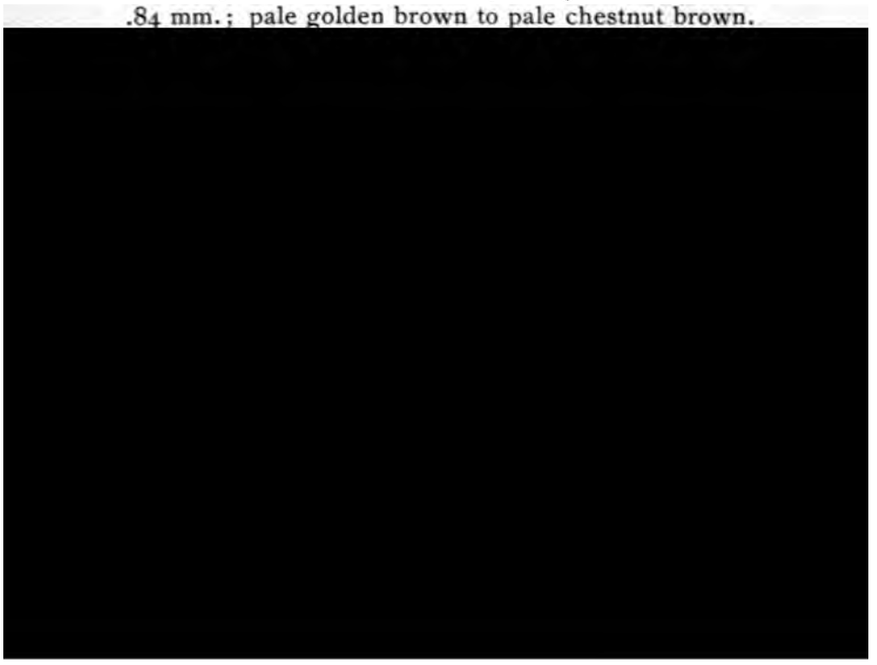
segment, with its lateral margins black. Sternal markings composed of a small trapezoid on prothorax with the posterior angles produced, and a broad blotch on metathorax; the anterior coxæ are produced forward and backward into broad lobe-like appendages, rounded in front and angulated behind. Legs concolorous with ground color of the body, with darker margins.

Abdomen, elongate ovate, with one long hair and several short ones rising on margin just in front of each uncolored posterior angle, and a series of hairs along posterior margins of segments; segments 1–8 with a broad, transverse, fuscous band darker at lateral extremities and black on extreme lateral margins; segment 9 uniformly colored, broadly rounded with narrow, uncolored, fringed, posterior margin.

Menopon loomisii n. sp. (Plate xv, fig. 6.)

Specimens taken from two specimens of the White-winged Scoter, *Oidemia deglandi* (Bay of Monterey, California). Named after Mr. Leverett M. Loomis, Curator of Birds, California Academy of Sciences.

Decription of female. Body, length 1.8 mm., width .84 mm.; pale golden brown to pale chestnut brown.



tional hairs on the occipital margin; a small, black, ocular fleck, dark brown ocular blotch, the mandibles black-tipped, the other mouth-parts and the basal segments of the palpi brown.

Prothorax with produced lateral angles obtuse, bearing two spines and a long hair, which is the terminal one in a series of fourteen ranged along the rounded posterior margin of the segment; the transverse line with curving vertical lines at its extremities is distinct. Metathorax with divergent sides, not quite as wide as head, with flatly convex posterior margin bearing a series of long hairs; in each lateral angle several small spines and the terminal hair of the posterior series. Legs concolorous with body; with scattered, rather long hairs.

Abdomen ovate, with broad transverse bands across all segments separated by wide uncolored sutures; in the anterior angles of each transverse band a small curving comma-like chitinous band; the segments with fine hairs on lateral margins, and longer weak hairs in the posterior angles; dorsal surface with hairs.

Menopon titan Piaget. (Plate xv, fig. 2.)

Les Pediculines, 1880, p. 503, pl. xl, fig. 7.

Tetraopthalmus chilensis Grosse, Zeitschr. f. wiss. Zool., 1885, vol. xlii, p. 530.

Many specimens of this species, or of a variety, found on four of five specimens examined of California Brown Pelican, *Pelicanus californicus* (Bay of Monterey, California), and on the White Pelican, *Pelicanus erythrorhynchus* (Lawrence, Kansas). These large conspicuous parasites are found not alone among the feathers of the host but also abundantly clinging to the inner surface of the gular pouch, a circumstance which suggests that feathers may not constitute the exclusive food of the parasites.

Piaget has described two species of these giant *Menopons* of the Pelicans, viz.: *titan* found on *Pelecanus ono-*

crotalus (Zool. Garden of Rotterdam) and *consanguineum* (Les Pediculines, Supplement, 1885, p. 116, pl. xii, fig. 7) found on *P. erythrorhynchus* (dried skin in Museum of Leyden). Picaglia has described a third species *ragazzi* (Atti d. Soc. d. Nat. d. Modena, 1885, serie iii, vol. ii) found on *P. trachyrhynchus* (Callao), and has established the subgenus *Piagetia* for the group. The characters of the subgenus are as follows: "abdomen narrow and very elongate; male longer than female; length more than 5 mm." The remaining members of the genus *Menopon* present in contrast these characters: "abdomen oval-elongate, rounded oval, or almost round; male smaller than the female; length varying from 1 to 3 mm." The species chiefly used by Franz Grosse in his study of the anatomy of the Mallophaga was a member of this *Menopon titan* group, taken from a Pelican, undetermined, from Chile.

It certainly seems advisable to indicate the peculiar characters of the group by assigning to it a subgeneric name; but I can hardly recognize in Picaglia's description of *ragazzi* characters other than the dimensions which make it recognizably distinct from *titan*. My

moving any likelihood of confusing it with *titan)*, and by designating *ragazzi* and my specimens as varieties presenting the following diagnostic characters:

Var. *ragazzia* Picaglia, from *Pelecaus trachyrhynchus* (Callao); small, length of male 3.42 mm., of female 3.15 mm.; mesothoracic suture indistinct; metathorax a little wider than the head; general color paler than *titan*.

Var. *impar* Kellogg, from *Pelecanus erythrorhynchus* (Lawrence, Kansas); with the minor differential characters of *ragazzi*, but almost as large as *titan;* length of male 4.7 mm., of female 3.8 mm.

Var. *linearis* Kellogg (Plate xv, fig. 2), from *Pelecanus californicus;* about same size as *titan;* length of male 5.2 mm., of female 4.2 mm.; transverse abdominal blotches not bifurcated at extremities, and the longitudinal uncolored lines beyond spiracles very distinct in female, forming an interrupted, uncolored, longitudinal line for full length of abdomen, setting off lateral abdominal bands which are darker than the other abdominal markings.

Menopon tridens Nitzsch. (Plate xv, figs. 3 and 4.)

? Germar's Mag. Entomol., 1818, vol. iii.

Lœmobothrium tridens Nitzsch. Zeitzschr. f. ges. Naturwiss. (ed. Giebel), 1866, vol. xxviii, p. 396.

Menopon scopulacorne Denny. Monograph. Anoplur. Brit., 1842, p. 221, pl. 18, fig. 9.

Menopon tridens Nitzsch. Burmeister, Handbuch. d. Ent., 1832, vol. ii, p. 440; Giebel, Insecta Epizoa, 1874, p. 296, pl. xvii, fig. 9; Piaget, Les Pediculines, 1880, p. 479, pl. xxxix, fig. 1.

I have taken several specimens of a *Menopon* from Coots, Grebes, and Loons and from a single Tern, which are referable to this species, or at least to the group of forms of which *tridens* is the described representative. The descriptions of *tridens* by Piaget and by Giebel differ positively in various particulars, noticeably in the characters of the hairs. My specimens agree exactly with

neither of these descriptions, and besides differ among themselves in size and shape of head to such a degree that I have arranged them in three groups to which I give, tentatively, varietal rank. These varieties are as follows:

Var. *pacificum* Kellogg, from the Pacific Loon, *Urinator pacificus* (Bay of Monterey, California), and from five specimens out of ten of the American Coot, *Fulica americana*, shot near Monterey, California, and on two specimens out of five of the same bird species from Lawrence, Kansas; measurements, female, length 1.65 mm., width .62 mm.; head, length .28 mm., width .5 mm.; smaller than the succeeding variety which it otherwise resembles.

Var. *insolens* Kellogg (plate xv, figs. 3 and 4), from an Eared Grebe, *Colymbus nigricollis californicus* (Bay of Monterey, California), and from a Forster's Tern, *Sterna forsteri* (Lawrence, Kansas); measurements, female, length 2. mm., width .72 mm.; head, length .31 mm., width .53 mm.; markings distinct and dark; lateral bands of abdomen nearly black.

Var. *par* Kellogg, from a Western Grebe, *Æchmophorus occidentalis* (Lawrence, Kansas); measurements, female, length 2 mm., width .78 mm., head, length .31

ference in size amounting to but one-tenth of a millimeter in total length in the female and half that in the male, was taken on *Fulica atra*. Nitzsch found the species on *Fulica atra*, *Gallinula chloropus*, *Crex porzana*, *Podiceps auritus*, *Podiceps cristatus;* Denny found his *scopulacorne* on *Rallus aquaticus*, *Podiceps minor* and *Gallinula chloropus*. The species is easily recognized by the peculiar trilobed process, function unknown, on the under side of the hind-head (see fig. 4, pl. xv).

EXPLANATION OF PLATES.

PLATE II.—Fig. 1, Alimentary canal and salivary glands of *Menopon mesoleucum* (after Nitzsch). Fig. 2, Alimentary canal of *Docophorus fusicollis* (after Nitzsch). Fig. 3, Nervous system of *Lipeurus baculus*(?) (after Nitzsch). Fig. 4, Female genitalia of *Menopon mesoleucum* (after Nitzsch). Fig. 5, Male genitalia of *Menopon pallidum* (after Nitzsch). Fig. 6, Respiratory system of *Menopon titan* (original). Fig. 7, Head, under side, of *Lœmobothrium* sp. (after Grosse). Fig. 8, Labium of *Tetraopthalmus chilensis* [=*Menopon titan*(?)] (after Grosse). Fig. 9, Labium of *Nirmus* sp. (after Grosse). Fig. 10, Antenna of *Tetraopthalmus chilensis* [=*Menopon titan*] (after Grosse). Fig. 11, Antenna of ♀ *Lipeurus*. Fig. 12, Antenna of ♂ *Lipeurus*. Fig. 13, Leg of ♂ *Tetraopthalmus chilensis* [=*Menopon titan*].

PLATE III.—Fig. 1, *Docophorus calvus* Kell., ♀. Fig. 2, *D. fuliginosus* Kell., ♂. Fig. 3, *D. graviceps* Kell., ♂. Fig. 4, *D. acutipectus* Kell., ♀. Fig. 5, *D. quadraticeps* Kell., ♀. Fig. 6, *D. montereyi* Kell., ♂. Fig. 7, *D. occidentalis* Kell., ♀. Fig. 8, *D. kansensis* Kell., ♀. Fig. 9, *D. atricolor* Kell., ♂.

PLATE IV.—Fig. 1, *Docophorus icterodes* N., ♀. Fig. 2, *D. pertusus* N., ♀ Fig. 3, *D. pertusus* N., juv. Fig. 4, *D. lari* Denny, ♀. Fig. 5, *D. insolitus* Kell., ♀. Fig. 6, *D. melanocephalus* Burm., ♀.

PLATE V.—Fig. 1, *Nirmus præstans* Kell., ♂. Fig. 2, *N. præstans* Kell., ventral aspect abdomen of ♂. Fig. 3, *N. hebes* Kell., ♀. Fig. 4, *N. farallonii* Kell., ♀. Fig. 5, *N. orarius* Kell., ♀(?). Fig. 6, *N. giganticola* Kell., ♂. Fig. 7, *N. bœphilus* Kell., ♀.

PLATE VI.—Fig. 1, *Nirmus punctatus* N., ♀. Fig. 2, *N. punctatus* N., juv. Fig. 3, *N. felix* Giebel, ♂. Fig. 4, *N. felix* Giebel, ventral aspect abdomen of ♂. Fig. 5, *N. signatus* P., ♂. Fig. 6, *N. pileus* N., ♀. Fig. 7, *N. lineolatus* N., ♂. Fig. 8, *N. lineolatus* N., ventral aspect abdomen of ♂. Fig. 9, *N. lineolatus* N., juv.

PLATE VII.—Fig. 1, *Lipeurus densus* Kell., ♀. Fig. 2, *L. densus* Kell., ventral aspect head and thorax of ♀. Fig. 3, *L. varius* Kell., ♀. Fig. 4, *L. varius* Kell., juv. Fig. 5, *L. celer* Kell., ♂. Fig. 6, *L. celer* Kell., ♀. Fig. 7, *L. longipilus* Kell., ♂.

PLATE VIII.—Fig. 1, *Lipeurus picturatus* Kell., ♀. Fig. 2, *L. picturatus* Kell., ♀ juv. Fig. 3, *L. diversus* Kell., ♂. Fig. 4, *L. diversus* Kell., ♀. Fig. 5, *L. limitatus* Kell., ♀. Fig. 6, *L. limitatus* Kell., outline of metathorax to show arrangement and character of hairs. Fig. 7, *L. constrictus* Kell., ♀ juv. Fig. 8, *L. constrictus* Kell., ♂.

PLATE IX.—Fig. 1, *Lipeurus ferox* Giebel, ♀. Fig. 2, *L. ferox* Giebel, ♂. Fig. 3, *L. forficulatus* Nitzsch, ♀. Fig. 4, *L. forficulatus* Nitzsch, ♂. Fig. 5, *L. forficulatus* Nitzsch, juv. Fig. 6, *L. forficulatus* Nitzsch, very young.

PLATE X.—Fig. 1, *Lipeurus temporalis* Nitzsch, ♂. Fig. 2, *L. testaceous* Tschb., juv. Fig. 3, *L. toxoceros* Nitzsch, juv. Fig. 4, *L. testaceous* Tschb., ♀. Fig. 5, *L. toxoceros* Nitzsch, ♂. Fig. 6, *L. squalidus* Nitzsch, ♀. Fig. 7, *L. squalidus* Nitzsch, posterior margin of metathorax showing arrangement and character of hairs.

PLATE XI.—Fig. 1, *Oncophorus advena* Kell., ♀. Fig. 2, *O. advena* Kell., head of ♂. Fig. 3, *Eurymetopus taurus* Nitzsch, ♀. Fig. 4, *E. taurus* Nitzsch, head of ♂. Fig. 5, *E. taurus* Nitzsch, ♀ juv. Fig. 6, *E. taurus* Nitzsch, ♂ juv. Fig. 7, *Giebelia mirabilis* Kell., ♂. Fig. 8, *G. mirabilis* Kell., outline of head of ♀.

PLATE XII.—Fig. 1, *Colpocephalum unciferum* Kell., ♂. Fig. 2, *C. unciferum* Kell., outline and last segments of abdomen of ♀. Fig. 3, *C. unciferum* Kell., juv. Fig. 4, *C. uniforme* Kell., ♀. Fig. 5, *C. pingue* Kell., ♂. Fig. 6, *C. timidum* Kell., ♀. Fig. 7, *C. funebre* Kell., ♀. Fig.

NORTH AMERICAN APTERYGOGENEA.

BY HARALD SCHÖTT.

[With Plates xvi-xviii.]

By the kindness of Dr. H. W. Harkness and through the mediation of Dr. Gustav Eisen, I have received for determination a collection of Apterygogenea, belonging to the California Academy of Sciences, as well as a collection belonging to Dr. Eisen personally. The examinations have to me been very interesting as leading to the discovering of several forms new to the science and giving an opportunity to control and correct several details concerning the Californian Collembola the descriptions of which were published by me in the year 1891. The types of both the above collections are now in the California Academy of Sciences of San Francisco.

The collection contains specimens found in upper and Baja California, Arizona and the Pacific Coast of Mexico, all having been collected by Dr. Eisen and Frank H. Vaslit. In my examinations of the Thysanura, I have consulted the following works: Il Sistema dei Tisanuri, by B. GRASSI and G. ROVELLI (Estratta dal Naturalista Siciliano, An 1889–90), Monograph of the Collembola and Thysanura, by Sir JOHN LUBBOCK, London, 1873, Synopsis of the Thysanura of Essex County, Mass., by A. S. PACKARD, JR. (in Fifth Annual Report of the Trustees of the Peabody Academy of Science for the year 1872), and Campodeæ en Familie af Thysanurernes orden ved FR. MEINERT (Naturhistorisk tidskrift, Kjöbenhavn, 1865, p. 400).

In the collection the following genera and species are represented:

COLLEMBOLA Lubbock.

Family SMINTHURIDÆ Lubbock.

Gen. I. SMINTHURUS Latreille.

Sminthurus longicornis n. sp.

Bluish black. The terminal joint of the antennæ is annulated and double the length of the preceding. Tibial tenent hair wanting. The upper claw is enclosed by a chitinous covering and armed with a large tooth. The lower claw is lanceolate, one-toothed and provided with a thread-like appendage. The dental segment of the furcula are wanting tenent hairs. The mucrones are spoon-shaped and serrated only in one margin. Length 1 mm.

This species is, by the shape of the mucrones, closely allied to *S. fuscus* Linn., but differs plainly by the articulation of the antennæ and in the want of tenent hairs on the caudal appendage.

S. fuscus Linn. has the terminal joint of the antennæ of the same length as the two preceding joints together, and has the two middle joints provided with large setæ. Our form, on the contrary, has the terminal joint of the antennæ evidently longer than the three preceding ones together, and the setæ on the middle joints replaced by

to the delineation of the animal, and by disregarding the difference that appears in the structure of the mucrones. These bear a great resemblance to those of *S. quadrilineatus* Tullb., from which, however, they differ in being flattened from the sides, and apparently serrulated. *S. niger* Lbk. has the mucro distinctly in the form of a channel, and serrated in both the margins.

Gen. II. Papirius Lubbock.

Of this genus I have in my materials also one individual, which has been found in Mexico by Dr. G. Eisen. On this single specimen I dare not, however, form a new species.

On a dirty white ground color there is on the back a large black spot with regular outlines.

Family ENTOMOBRYIDÆ Schött.

When, a few years ago, I was occupied with Collembola from California, I found a form, belonging to the family Entomobryidæ, which differed from all the others by the falcated mucronal segment. Until further I referred the form to a new genus *Drepanura*. Afterwards I have had an opportunity to study collections from Italy, Africa and America. In all of them I have found forms, among other characteristics also presenting the above mentioned. By the segmentation of the body they are all connected with the type of *Lepidocyrtus* Bourl., or *Entomobrya* Rond.

I therefore think that the greatest order is attained when (1) to the gen. *Lepidocyrtus* Bourl., all the forms are referred which have the mesonotum more or less projecting and the body clothed with scales, (2) to the gen. *Entomobrya* Rond., forms with the mesonotum not projecting and without scales, and finally (3) to the gen.

Sira Lbk. forms clothed with scales but with the mesonotum not projecting. In consequence of this, the two temporary genera *Drepanura* and *Pseudosira*, before proposed by me, are to be excluded from the system.

Gen. I. TOMOCERUS Nicolet.

Tomocerus americanus n. sp.

The dental spines are 9–11, the two upper and the two lower of which are considerably longer than the others. The upper claw is provided with three or four teeth. The lower claw is lanceolate and provided with one tooth. Length 4 mm.

As to the disposition of the dental spines of the caudal appendage, the above species is closely allied to *T. flavesecens* Tullb. A pointed scale near the inner spine is also to be found. The number of the spines seems to vary considerably.

The variation is generally confined to the numbers 9–11. Characteristic is the disposition of the two flank spines in each end, considerably surpassing the others in length. The upper claw of the first pair of extremities often has four teeth, that of the other pair three. Also in this I

Gen. II. LEPIDOCYRTUS Bourlet.

Lepidocyrtus Parckardi n. sp.

(The specific name is given in honor of Professor A. S. Packard, Jr.)

White with a bluish black delineation. The eyes are sixteen, eight on each side of the head. The terminal joint of the antennæ is longer than the preceding. The upper claw is strongly developed and provided with three teeth. The lower claw is lanceolate and unarmed. The furcula is long; the dentes are rapidly tapering, twice as long as the manubrium; the mucrones are long and thin, at the point provided with only one hook. Length 3.5 mm.

The second joint of the *antennæ* is slightly longer than the third, which is about half as long as the terminal joint. The terminal segment of the *furcula* is very narrow, a little curved, and provided with only one tooth. The *body* is covered with hairs, now club-shaped, now pointed and bristly, or even simple and straight. The first sort of hairs are heaped between the several segments of the body and on the head, the second on the dentes of the furcula, the third everywhere on the animal, especially on the antennæ and extremities.

From the specimens at my disposal it cannot be positively concluded as to the real *color* of the animal. The ground color seems on alcoholic specimens to be pure white, and the delineation bluish black. The antennæ are now bronze-brown, now deep blue.

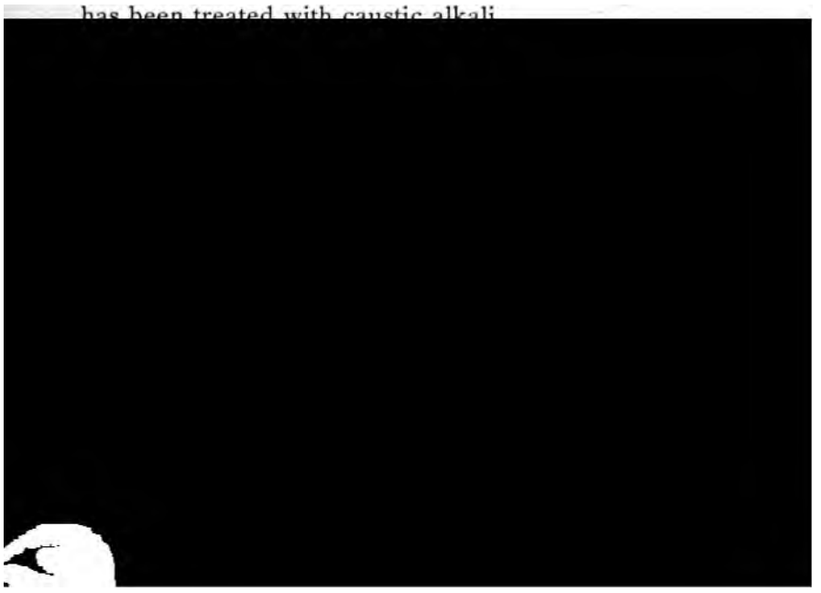
Habitat. Sierra Laguna, Baja California. (Coll. G. Eisen.)

Lepidocyrtus fulvus n. sp.

Yellow. The eyes are sixteen, eight on each side of the head. The second and third joints of the antennæ are of about the same length, the terminal joint a fourth longer

than the preceding. The upper claw is rather curved, in the middle provided with a notch, and near the point with a tooth. The lower claw on the first pair of extremities is running out into three points, on the other pairs into two. The mucronal segment of the furcula is short, large, and furnished with one hook. Length 1.5 mm.

The *upper claw*, rather curved and nearly cuneate, is in the middle of the inner margin provided with a notch, and towards the point of the claw with an apparent tooth. The *lower claw* seems to be somewhat different on the several pairs of extremities. On the first it is at the point cut off obliquely on both sides of the middle line and runs out into three points, on the two posterior pairs the margin only directed towards the upper claw is cut off, and the claw, therefore, runs out into only two points. The *tibial tenent hair* is swollen. The *furcula* is rather short, and has the mucro large and not attached to the dentes with any neck, as is the case with all the other forms provided with only one hook. The *scales* are all elliptical; under the immersion-lens they seem to be provided with short ribs, close lying, and as to the place exactly corresponding to the depressions which are characteristic of the other species of the genus *Lepidocyrtus* Bourl. The scales, strange enough, do not appear before the animal has been treated with caustic alkali.



Gen. III. CREMASTOCEPHALUS n. g.

(Derivatio κρέμασθαι and κεφαλή)

Cremastocephalus trilobatus n. sp.

The head is hanging down. The thorax is curved. The mesonotum covering the pronotum, but not projecting over the posterior part of the head. The fourth abdominal segment occupying the half of the body. The antennæ are nearly twice as long as the body, 4-jointed, with the basal joint strongly developed. The eyes are sixteen, eight on each side of the head. The tibial tenent hair is enlarged at the end. The upper claw is furnished with two teeth, extremely fine. The lower claw is obliquely cut off at the end. The dentes of the furcula are nearly of the same width all along. The mucro widely rectangular, running out into three large points, and furnished with a scale, hanging down in front. Scales wanting. Length 3 mm.

This genus, on a superficial inspection, seems to join characters derived from two genera before set up by me, the *Campylothorax* and *Trichorypha*. To the former it has some resemblance in the curved thorax and in the strongly developed basal joints of the antennæ; to the latter in the shape of the mucronal segment of the furcula. From *Campylothorax*, however, it may easily be distinguished by the following characters:

(1) The shape of the *mesonotum*. (2) The number and disposition of the *eyes*. (3) The shape of the *mucronal segment*, and (4) The absence of *scales*. From *Tricorypha* it is to be distinguished by (1) the *curved thorax;* (2) the disposition of the *eyes*, and (3) the absence of *scales*.

The *head* is hanging down and the *thorax* curved, so that the form, as I said, on a superficial inspection, looks like a species of *Campylothorax*. The curvation of the body, however, is not produced by the angular *mesonotum*,

but the head and the thoracic segments have to each other a certain bend forward. The *pronotum* is quite concealed by the mesonotum, which, however, does not project over the posterior part of the head. The *mesonotum* is a little longer than the *metanotum*, which also is somewhat longer than the first abdominal segment. The *second abdominal* segment is nearly thrice as long as the third; the fourth occupies about half the body. The *ocelli* are sixteen in number, eight on each side of the head. Their disposition will appear from the drawing. The *antennæ* have the basal joints strongly developed and reach almost to the point of the mucrones, if the caudal appendage is stretched out. They are four-jointed, and have the basal and terminal joint of about the same length; the second joint is nearly twice as long as the third. The outer joint often fails. The *tibial tenent hair* is thick and enlarged at the end, but not ball-shaped. *The upper claw* is slightly curved and provided with two teeth, extremely small, which can be seen only under high magnifying power. The *furcula* is very characteristic. The manubrium is not quite as long as the dentes, which slightly taper towards the points. The mucronal segment being

have observed in only one specimen. In the others they are probably broken off. On the body, and especially on the antennæ and extremities, there also are extremely fine long hairs, standing out at right angles. *Skin scales* wanting.

To judge from my materials, the color of the animal seems to be rather variable. I am going to describe two types.

(1) Ground color dirty yellowish white. Along the back a dark band runs, broken off at the joints, and increasing in strength on the great abdominal segment. On the thoracic segments the band has a rusty brown color, passing on the abdomen into nearly black. The antennæ are dark yellowish, and have a thin covering of dark violet color, increasing towards the ends of the joints, where it forms real rings. The two outer joints of the antennæ often are dark violet.

(2) Along the sides of the segments rather broad black borders are running, which appear most distinctly on the second and third thoracic segments and on the two first abdominal segments; then they dissolve in extended spots of the same color. Further inwards on the back, near the middle line of the body, there run two rusty brown lines of about the same width which are broken off at the joints of the segments and finish on the second abdominal segment. These lines also can be observed on the great abdominal segment, but there they run a little nearer to each other, are thin in the middle and increase in breadth towards the ends. They do not reach quite to the end of the segment. Two spots of the same color are to be seen on the fifth abdominal segment. The appendicular parts are yellowish. The bases of the attennæ are encircled by black rings. Such rings also are met with at the points of the three inner joints.

Habitat. San Miguel de Horcasitas, Sonora, and Tepic, Mexico. (Coll. Eisen and Vaslit.)

Gen. IV. ENTOMOBRYA Rondani.

Entomobrya cæca n. sp.

White. The eyes are wanting. The antennæ have the third joint pear-shaped, about half as long as the terminal joint. The upper claw is provided with three teeth, the two inner of which are very strong. The lower claw is running out into two diverging points. The mucro is provided with one hook. Length 1 mm.

The *upper claw* is formed in the same manner as in the forms which have before constituted the genus *Sinella* Brook. The *lower claw* is unarmed on the inner margin, furnished on the sides with longitudinal ridges, and has an appendix hanging downwards which consists of an extremely thin chitinous lamel, running out into a point. The claw, therefore, seems to be two-pointed. On the *tibia* a tenent hair, swollen at the end, can be observed.

The *hairs* of the two specimens which I have at my disposal are very scarce. Groups of club-shaped setæ are, however, to be seen on the posterior part of the head and between the forward thoracic segments.

Habitat. San Francisco, California. (Coll. G. Eisen.)

joints of about the same length and the terminal joint nearly twice as long as the preceding. The *upper claw* has three teeth, the two interior of which are very large. At the first glance we can distinguish only two teeth, owing to the circumstance that the two interior are placed beside each other. By the aid of a strong microscope and with different focusing of the tube, it can, however, easily be observed that the bases of the two teeth are parallel and situated on each side of the claw, and that their respective points diverge, so that they are angular to each other. On a preparation, the lower tooth, with a precise regulation of the tube, seems to be very strongly developed, while the upper one seems to be much smaller. The difference is owing to the inferior tooth appearing in its whole extent from the side, while the upper one appears only in part and from above. The *lower claw* is lanceolate and without any teeth. There is a *tibial tenent hair*, but with no swelling at the point. As to the form of the *caudal appendage*, there is a complete coincidence with the preceding species.

As the scales are more or less completely fallen off, the *color* of alcoholic specimens is pure white.

Habitat. Berkeley, California. (Coll. G. Eisen.)

Entomobrya curviseta Brook.

Dirty white, marked with brown spots. The eyes are four, two on each side of the head. The terminal joint of the antennæ is longer than the third. The upper claw has three teeth, the two interior of which are very strong and placed beside each other. The lower claw is lanceolate and unarmed. The mucro is provided with two hooks. Length 2 mm.

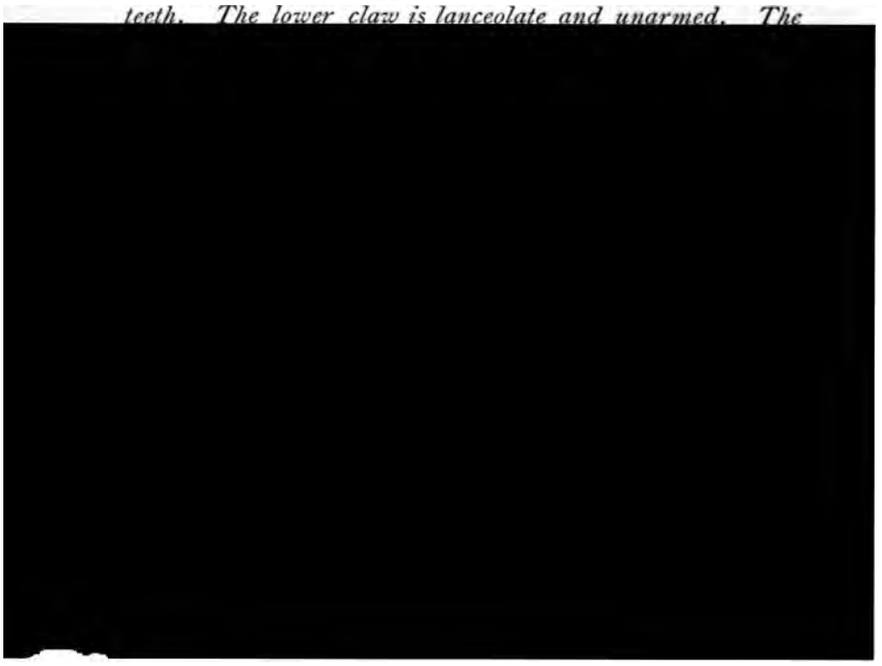
Syn. 1882, *Sinella curviseta* Brook, Linn. Soc. Journ. Zool., vol. xvi, p. 541.

For reasons mentioned in my "Beitr. Z. Kenntn. Cal. Coll.," p. 20, I think that the above form is to be referred to the genus Entomobrya Rond., and I am confirmed in my opinion by my having found in the materials now at my disposal two species of the above genus, the one of which is characterized by three ocelli, the other by one on each side of the head. The plumiform setæ, characteristic of the genus Sinella Brook, which are hanging down on the sides of the mucronal segment, though less developed, are to be seen on all the species belonging to the genus Entomobrya Rond. The other characteristics of Sinella, the shape of the upper claw and the absence of swelling on the tibial tenent hair, seem to me to be insufficient as foundation for a separate genus.

Of this very interesting type I have a specimen from Sebastopol, California (coll. G. Eisen). Before only known from Finland (Reuter) and England (Brook).

Entomobrya sexoculata n. sp.

Violet. The eyes are six, three on each side of the head. The three outer joints of the antennæ are of about the same length. The upper claw is provided with three teeth. The lower claw is lanceolate and unarmed. The



this species resembles much that of *E. myrmecophila* Reut. On the white-yellow ground-color blue-violet spots are closely spread. The *antennæ* are bluish, the extremities and furcula colorless.

Habitat. Berkeley and Alameda, California; Sonora, Mexico. (Coll. G. Eisen.)

Entomobrya atrocincta n. sp.

Honey yellow. On the head an anchor-like spot and two brownish lines going through the eye-patches. The second thoracic segment inclosed by a dark margin. The posterior of the third thoracic and the first abdominal segment black-brown. The eyes are sixteen, eight on each side of the head. The three outer joints of the antennæ are of the same length. The upper claw provided with two small teeth. The lower claw is lanceolate and unarmed. The mucro is provided with two hooks. Length 1.25 mm.

The terminal joint of the *antennæ* is generally wholly blue-violet. The dark transverse sharply contrasts with the waxen ground-color. The animal is very richly clothed with alternately club-shaped and pointed hairs. The body seems to me to be somewhat thinner than that of the European species of the above genus.

In my materials there are many individuals without any distinct delineation. They sometimes are quite yellow, sometimes provided with a pale dark delineation on the head and on the anterior segments of the body. These are, no doubt, young animals. It is possible that Packard has before described this species under the name of *Degeeria perpulchra*, of which he says: "This exquisitely pretty form may be at once known by its small size, the black band around the head or on front and side of thorax and the honey yellow abdomen." In that case he has had a young specimen before him.

Habitat. Hanford, California. (Coll. G. Eisen.)

Entomobrya multifasciata Tullberg.

White yellow. Dark transverse bands on the posterior margins of all the truncal segments; an apparent transverse with irregular outlines on the fourth abdominal segment. The eyes are sixteen, eight on each side of the head. The three outer joints of the antennæ are of the same length. The upper claw is provided with three teeth. The lower claw is lanceolate and unarmed. The mucro is provided with two hooks. Length 1.5 mm.

Of this species, already known from California, about thirty individuals were found by Dr. G. Eisen, at Berkeley, California.

From this place also is to be found in great number a variety that is characterized by the posterior of the third abdominal segment being almost totally dark, and by the transverse of the fourth increasing considerably in size.

Entomobrya triangularis n. sp.

White. Round the head through the eye patches there is a faintly marked dark ribbon. The pronotum is bluish, the mesonotum included by a broad border of same color. The first, third and sixth abdominal segments are dark.

segment of the caudal appendage, and partly the same coloring.

Having had at my disposal only one individual, which I have wished to spare from dissection, I cannot give any account of the number and disposition of the eyes.

Habitat. San Francisco, California. (Coll. G. Eisen).

Gen. V. TEMPLETONIA Lubbock.

Templetonia quadrioculata n. sp.

White. The eyes are four, two on each side of the head. The terminal joint of the antennæ is not annulated. Length 1.5 mm.

The type of this genus, *T. nitida* (Temple), is to be recognized by two eyes, one on each side of the head. In our species, however, the *eyes* are four. They are nearly of the same size and are placed transversely close by each other. The terminal joint of the *antennæ* is not annulated, therefore this characteristic must exit out of the diagnosis of the genus.

As to the other characteristics, the shape of the *claw-joints*, of the *extremities* and of the terminal segment of the *caudal appendage*, there is a complete coincidence between the two species. The *color* of alcoholic specimens is pure white, as the scales are more or less completely fallen off.

Habitat. Berkeley, California. (Coll. G. Eisen.)

Gen. VI. ISOTOMA (Bourlet).

In conformity with the opinion about the systematization of the genus *Isotoma* Bourl., which I have introduced in my memoir Zur Systematik und Verbreitung palæarctischer Collembola, the variety of *T. viridis* Bourlet, which I have already before had an opportunity to note from California, ought to change the name *aquatilis* Lbk., for *riparia* Nic.

Isotoma palustris Müller var. **balteata** Reuter.

Dirty white-yellow, with dark transverses on all the truncal segments. The eyes are sixteen, eight on each side of the head. The antennæ are twice as long as the head, and have the three outer joints all of the same length. The third abdominal segment is about as long as the fourth. The upper claw is unarmed. The lower claw is provided with a little tooth, directed upwards. The mucro is provided with four hooks, three of which are placed in a row one after another and the fourth on the outside of the segment. The body is densely clothed with short and simple hairs. Length 1.25 mm.

Syn. 1893, *Isotoma palustris* Müller var. *balteata* Reut., Zur Syst. u. Verbr. palæarct. Coll., p. 66.

Of this well marked variety, which has been found before only in Finland, my material contains twenty individuals, found by Dr. G. Eisen in the vicinity of Lake Chabot, near Oakland, California.

Isotoma fimetaria (Linn.) Tullberg.

White. Eyes are wanting. The terminal joint of the antenaæ is about twice as long as the preceding one. The third abdominal segment is shorter than the fourth. The

Isotoma lacustris Schött.

Dark violet. The eyes are sixteen, eight on each side of the head. The antennæ are not longer than the head, and have the three outer joints of nearly the same length. The third abdominal segment is shorter than the fourth. The claws are unarmed. The caudal appendage reaches the ventral tube. The dentes are all over of the same breadth. The mucro is formed out of thin chitinous lamels, and provided with two hooks. Length 2 mm.

Syn. 1893, *Isotoma litoralis* Schött, Zur Syst. u. Verbr. palæarct. Coll., p. 75.

I have changed the name of the above species because Monier, in his valuable paper, *Acaricus et Insectes marines des côtes du Boulonnais, has already before made use of the specific name *littoralis* for an *Isotoma* described by him.

I. lacustris Schött has a special interest, because of its near relation to *I. crassicauda* Tullb. Having before in my memoir Zur Syst. und Verbr. palæarct. Coll., put forth the distinguishing marks of the two species, I will, however, give some detail figures illustrating the fact stated.

Habitat. The vicinity of Lake Chabot, near Oakland, California. (Coll. G. Eisen.)

Family LIPURIDÆ Lubbock.

Mr. MacGillivray, in his valuable memoir on North American Thysanura, proposes to alter several of the names now commonly used for the genera of the family *Lipuridæ*. I have no objection to abandoning the generic terms *Anura* Gerv. and *Lipura* Burm., both being, as the author justly observes, "preoccupied in Mammalogy." (Gray gave, in 1838, the name of *Anoura* to a

*Extrait de la Revue Biologique du Nord de la France. Lille, 1890, p. 32.

cheiropter, and, in 1840, it was also applied to a form of ophiuridea. *Lipura* was, in 1811, used by Illiger to denote a genus of pachyderms, and, in 1819, the nearly related name of *Lipurus* was given to a marsupial.) But I cannot well understand why the generic term *Anurophorus* Nic. should be abandoned. The reasons given by Tullberg for retaining it (Sv. Pod., p. 55) seem to me quite satisfactory. It is true that the *Anurophorus laricis* of Nicolet was, in 1842, placed by Bourlet in the genus *Adicranus*, and that Gervais, in 1844, placed it in the genus *Lipura;* but as we know with certainty to which form Nicolet applied the name, and that he used it as early as 1841, I think we are not only entitled, but also, on account of its undoubted precedence, obliged to retain it. Nor can I agree with the author when he retains in the genus *Achorutes* Templ. only the forms that want anal spines, proposing a new genus *Schoturus* for those of its forms that have such appendages. It seems as if this alteration would easily create some confusion.

From the well defined genus *Anurida* Laboulb., the author excludes the species *granaria*, regarding it as the type of a new genus only on account of its having *no ocelli*. But if this were a sufficient reason for such an

Of this species, already before known from California, I have in my materials about thirty individuals from San Francisco (coll. G. Eisen).

Achorutes armatus Tullberg.

Brownish purple. The extremities are biunguiculate. The dentes furculæ are thick and twice as long as the mucrones, which have the form of a hook. The anal spines are extremely long. Length 1 mm.

Twenty-four specimens from Berkeley and four specimens met with in the neighborhood of Lake Chabot, California (coll. G. Eisen).

Gen. LIPURA Burmeister.

Lipura inermis Tullberg.

White. The elevations of the postantennal organ are 14. The eyelike points on the basis of the antennæ are 2.

Of this species, which I have before had occasion to note down from California, several specimens have been found by Dr. G. Eisen near Lake Chabot.

I will in this connection observe that Dr. Einar Lönnberg has found specimens of the above form and of *Anurida Tullbergi* Schött on the shore of a lake near the railway station Clarcona, Orange County, as well as some hundred individuals of *Anurida maritima* Laboulb. along the seashore at Key West, Florida.

THYSANURA Lubbock.

Family CAMPODEADEÆ Lubbock.

Gen. I. CAMPODEA Westwood.

Campodea staphylinus Westwood.

Of this form I have in my materials only one specimen, which, unfortunately, is incomplete.

Habitat. San Francisco, California. (Coll. G. Eisen.)

Family MACHILIDÆ Grassi.

It is a rather difficult task to try to identify alcoholic specimens belonging to this family. According to Grassi and Rovelli, the following characteristics constitute the species within the only genus of the family:

1. The length of the antennæ and of the median cercus.
2. The thoracic hump, more or less apparent.
3. The eyes.
4. The color of the body.
5. The shape of the scales.

As the color is dependent on the scales, which generally more or less fall off, when the insects are laid in spirits of wine, and, moreover, as individuals preserved are rarely found without the antennæ and caudal appendages broken off, the difficulty of easy identification will be understood.

I also have considered it more proper to leave a few *Machilides* as indeterminable.

Gen. I. MACHILIS Latreille.

Machilis aurantiacus n. sp.

The head is small. The eye patches are somewhat more

size and tapering, they seem to be longer than the body. The basal joint of the antennæ is rather large and about thrice as long as the following, nearly ball-shaped joint. Of the annular small joints then following, the inner are somewhat longer than the following, all of which are of about the same length. The color of the antennæ is brownish black. The *maxillary palpi* are flame yellow, and thickly beset with small black setæ. The *extremities* are also provided with short large setæ, which, by their dark brown, almost black color, make a sharp contrast with the light ground color of the animal. This is citrine, and on each tergit are running 8–10 orange colored transverse lines. The joints between the several segments are light yellow. The thoracic tergits are lighter than the abdominal ones. The *median cercus* is not exactly as long as the body. I cannot determine the length of the lateral cerci, because they are hurt in all my specimens. Probably they are much smaller than the median one, for they are much thinner than this.

Habitat. Sierra Nevada and Monterey, California. (Coll. Miss Alice Eastwood.)

Family LEPISMATIDÆ Burmeister.

Gen. Lepisma Linné.

Before entering on a detailed description of species, I will point out a characteristic not before taken notice of, which seems to me to be very useful for the distinction of the species. It is met with on *the cuticula*, which is easily laid bare by dissection or boiling in caustic alkali. The cuticula then appears under the microscope either quite smooth or ornated with a network of chitinous ribs. In both cases it is lightly strewn with small, elevated anchor-like figures, which are connected with the fastening of the scales.

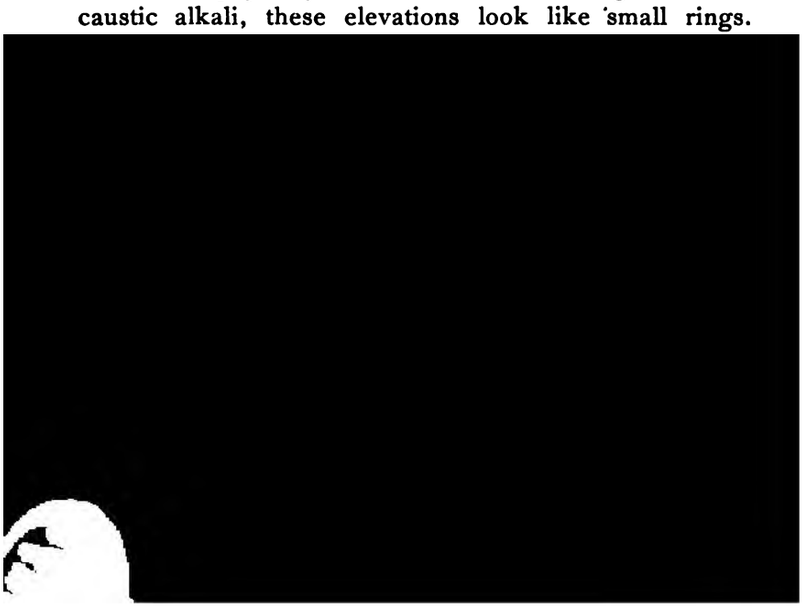
With respect to the number and disposition of the back hairs, the two following species are to be referred to the group:

LOPOTHRICHI Grassi and Rovelli.

Lepisma rubro-violacea n. sp.

The head has the form of a hat. The body is elongate, backwards gradually tapering. The labial palpi are three-jointed. The maxillary palpi are five-jointed. The antennæ are indistinctly annulated with reddish brown and white. The telson is subtriangular and furnished with two chitinous hooks. The cerci are distinctly annulated with brown and white. The head is yellowish white, and in front regularly colored reddish violet. The thoracic tergits are yellowish white. The abdominal tergits are reddish violet. The cuticula is smooth, with anchor-like figures. The scales are brown. Length 10–12 mm.

The *head* is formed rather like a round crown of a hat, and, when deprived of scales, yellowish white. On the anterior margin of the upper side there are to be observed some reddish violet spots, regularly disposed, and with outlines rather indistinct. Under the microscope these spots closely appear to correspond to areas thickly strewed with small papillary elevations. After being boiled in caustic alkali, these elevations look like small rings.



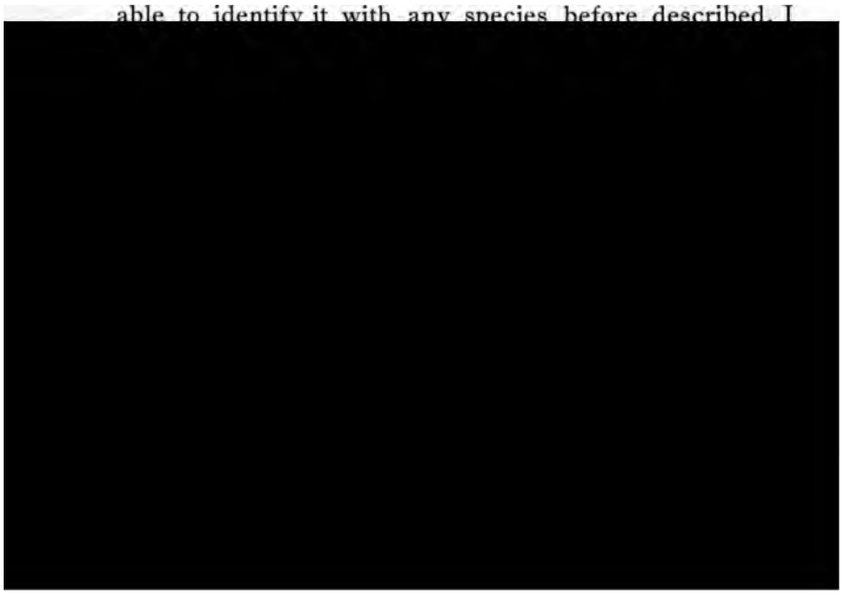
joints are thicker than the others; the third is somewhat longer than each of the following ones. Their color is pale brownish violet.

The *labial palpi* are three-jointed, and have the basal joint somewhat longer than the following one. The terminal joint is thicker than the others and irregularly triangular in form. They are uncolored.

The *thoracic tergits* are shield-shaped and broader than the abdominal tergits. Their ground-color is yellowish white, and they are covered with dark brown scales, which in alcoholic specimens remain only on the sides of the tergits. On the *abdomen* almost all the scales are fallen off, exposing a reddish violet ground-color. In several specimens acute-angled areas, surrounded by light lines, can be observed on the abdominal tergits. When the animal is looked upon from above, the *telson* seems to be widely triangular with the point slightly produced. When cut off, it appears to be such as the drawing shows. The chitinous hooks, mentioned in the diagnosis, which in entire specimens are difficult to discern, appear most distinctly on the segment, when cut off. The *cerci* are distinctly annulated with reddish brown and white. At the bases of the organs the rings are smaller and increase in extent towards the points. The joints towards the points of the antennæ become longer and swollen. For the same reason that was mentioned concerning the antennæ, I cannot decide the length of the cerci. Probably they are longer than the body. The *extremities* are annulated with yellow and brown. The *cuticular figures* are anchor-like and lie scattered on a bottom quite plain. The *scales* are brown, and, therefore, the insect when alive probably bears this color. The drawing belonging to this description represents alcoholic individuals. I have thought fit to give a colored

drawing of such a specimen, since in most cases there are only materials conserved to be had for examination. On the anterior margin of the head four tufts of fine upright hairs can be observed. On the body the hairs are more or less fallen off. In order to form an opinion of their disposition you may with success resort to dissection or boiling in caustic alkali. Then the ring-shaped elevations from which the hairs of the animal arise can be observed on the bare cuticula. On the lower margin of the *thoracic tergits* two rows of such elevations, directed obliquely outwards and downwards, can be observed. Each row consists of about ten elevations. Besides, there are at the lateral margins of the segments ten similar rows transversely disposed, each consisting of 3–4 elevations. Each row is accompanied by a cuneate reddish brown spot. On the lower margins of the abdominal segments four rows of elevations obliquely disposed are to be found. The inner ones seem to consist of 10–12 elevations, the outer ones of 8–10. The terminal abdominal tergit is furnished with long, fine hairs on both sides of the median cercus.

The above species is richly represented in the Californian collection and seems to be very common. Perhaps it is already described. However, as I have not been able to identify it with any species before described, I



gular, The cerci are distinctly annulated with reddish brown and white. The ground-color is yellow. The scales are brown, alternately light and dark; the dark ones arranged at the posterior margins of the tergits in groups, symmetrically hanging down. The cuticula is furnished with a network of chitinous bars. Within the meshes the anchor-like cuticular figures are to be seen.

The examination of this species has been of particular interest to me, because the *scales* have remained quite unhurt. The *head*, rounded in front, is on the upper side closely covered with dark brown scales. The *antennæ* resemble those of the preceding species. The points are broken off, owing to which their length cannot be decided. The *maxillary palpi* are 5-jointed, with the terminal joint thin and leg-formed. The *labial palpi* are 3-jointed, with the terminal joint very much swollen. At the basal joint a thin triangular chitinous scale is to be distinguished. The shield-shaped *thoracic tergits* are about equal in size and decorated with short light yellow striæ, regularly arranged. The first and third tergits are at the posterior margin furnished with two, the second with three incisions. On both sides of these the dark scales are heaped downwards forming appendages, the two lateral of which are rounded, the intermediate (one or more) abruptly cut off. In at least eight abdominal tergits such incisions also can be traced. Instead of giving a detailed description of these and their number in each tergit I refer to the drawing. *The telson* is short and very distinctly annulated with reddish brown and white. At the bases of the organs the rings are of small extent and lie rather closely. Further out the alternating colors extend over a great number of small segments (4–5), and in the middle of the white rings a very fine dark ring can be traced. The length of *cerci* cannot be de-

cided. The *extremities* are alternately colored light and dark. The *cuticula* is covered with a network of rather thick chitinous bars, the disposition of which is represented in the adjoined drawing. Within the meshes there are figures of the same appearance as in the preceding species. The groups of *hairs* on the particular tergits are disposed like the rows of elevations of the preceding species and seem to consist of chitinous bars, bifid at the end and hairs, of which some are feather-like and others naked. The number of hairs in each group seems to be nine.

As to the integument of hairs it must be added that groups of fine setæ are hanging down from the posterior margin of the telson, and that the cerci are richly covered with hairs. Unfortunately I have had only two individuals of this species at my disposal and one of them has been given up to the dissecting needle.

Habitat. San Francisco, California. (Coll. G. Eisen.)

EXPLANATION OF THE FIGURES.

PLATE I.

Sminthurus longicornis n. sp.

Fig. 1. Antenna.
2. Claw of the first pair of extremities.

Sminthurus albipes n. sp.

3. Mucro.
4. Claw of the first pair of extremities.

Sminthurus niger Lbk.

5. Mucro.

Tomocerus americanus n. sp.

6. Dentes furculæ.
7. Claw of the first pair of extremities.

Lepidocyrtus fulvus n. sp.

8. Claw of the third pair of extremities.
9. Claw of the first pair of extremities.
10. Mucro.
11. *Lepidocyrtus Packardi* n. sp.
12. Mucro.
13. Claw.

Entomobrya cæca n. sp.

14. Antennæ.
15. Claw of the first pair of extremities.
16. Mucro.

Entomobrya bioculata n. sp.

17. Ocellus and antenna.
18. Mucro.
19. Claw of the first pair of extremities.
20. *Cremastocephalus trilobatus* n. sp.
21. Claw of the first pair of extremities.
22. Mucro.
23. Ocelli.
24. Ocelli of *Campylothorax longicornis* Schött.

PLATE II.

Fig. 25, 26. Hairs of *Cremastocephalus trilobatus* n. sp.

Entomobrya curoiseta Brook.

27. Ocelli and antenna.
28. Mucro.
29. Claw of the first pair of extremities.

Entomobrya sexoculata n. sp.

30. Ocelli.
31. Mucro.
32. Claw of the first pair of extremities.

Templetonia quadrioculata n. sp.

Fig. 33. Ocelli and antenna.
34. Claw of the first pair of extremities.
35. *Entomobrya atrocincta* n. sp.
36. *Entomobrya triangularis* n. sp.
Isotoma palustris Müll. var. *balteata* Reut.
37. Mucro.
Isotoma lacustris Schött.
38. Mucro.
39. Claw of the first pair of extremities.
Isotoma crassicauda Tullb.
40. Mucro.
41. Claw of the first pair of extremities.
Machilis aurantiacus n. sp.
42. Head.
43. Maxillary palpus.
44. Cuticular figure.

PLATE III.

Fig. 45. *Lepisma rubro-violacea* n. sp.
46. Cuticular figure.
47. Head.
48. Telson.
49. First and second thoracic tergits.
50. First abdominal tergit.
51. Hair.
52. *Lepisma reticulata* n. sp.
53. Base of antenna.
54. Labial palpus.
55. Maxillary palpus.

NOTES ON PALÆOZOIC CRUSTACEA, No. 5. — CARBONIFEROUS TRILOBITES FROM MISSOURI.

BY ANTHONY W. VOGDES.

Among a large number of trilobites lately sent me by Prof. G. C. Broadhead, from the Chouteau limestone of Providence and Sedalia, Missouri, there are several specimens of smooth pygidia, which may be classed as new to science. Although this characteristic is known to several genera of fossil crustacea, it is uncommon. We recall *Calymene Arago* and *C. Salteri* Rouault, from the Silurian of France; *Proetus crassimargo* Rœmer, from the Devonian of Germany, and *Proetus? levis* Woodward, from the Carboniferous of England.

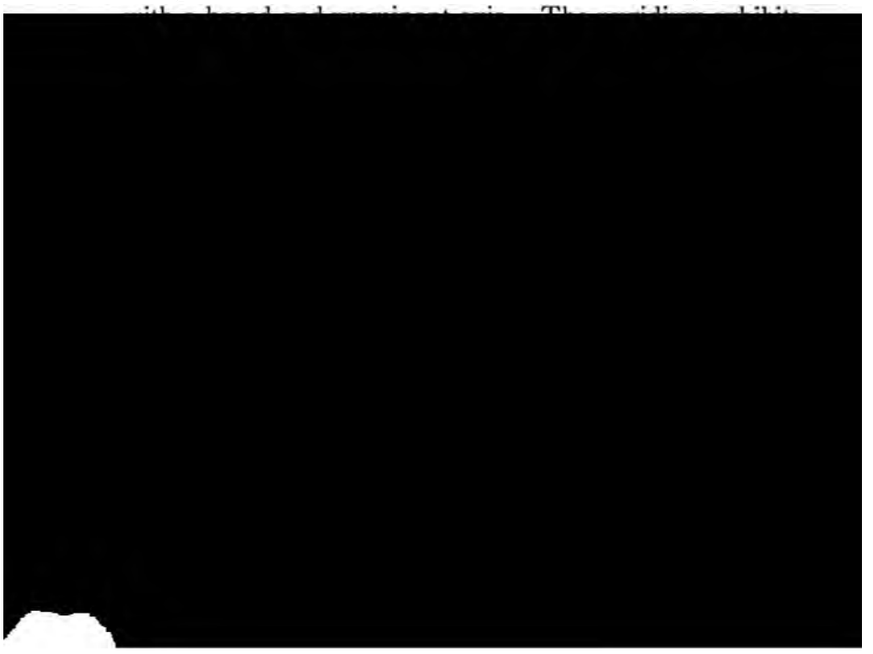
The German species was first described by F. A. Rœmer, in Palæontographica, Bd. 2, s. 65, tab. x, fig. 9, from several fragments. The author remarks regarding the pygidium, that "The axis of the pygidium exhibits three distinct and indications of seven more rings, the lateral lobes near the upper edge slightly indicate three pleuræ; the other part is smooth, but shows at the lower edge indications of ribs."

In the reclassification of this species by Novàk, in Dames and Kayser's Palæont., Bd. 1, Heft 3, s. 44, it is divided into three species, namely: *Proetus crassimargo* Rœmer, *P. Frechi* Novàk, and *P. orbitatus* Barr.

Novàk says that *Proetus crassimargo* belongs to the ten-jointed Proetidæ, typical of the group *Proetus orbitatus*. The head differs from the latter by being less arched, by a narrower glabella, which is more pointed in front, slightly compressed between the anterior ends of the palpebral lobes, and bordered by less convex dorsal furrows. It is also more distinctly marked with side furrows, eyes larger, and by a node which is not at the posterior edge, but in the middle of the neck ring; also by the

edge being more elevated, the furrow of the cheek, which meets the posterior cheek furrow at right angles, and the coarser granules which cover the whole surface of the glabella and cheeks. The pygidium can readily be distinguished from *Proetus orbitatus* by its distinctly flat arch and less length, more breadth, more prominent segmentation and narrower axis; also by the granules of the shell on the rings. These are arranged in duplicate rows of nodes, two exterior and two interior rows; those of the exterior are rounded in form and generally located at the end of the rings or at the border of two neighboring rings. Those of the interior rows are triangular, pointed backwards, and are always connecting with the furrows dividing the rings. Analogous impres sions can be seen on well preserved specimens of *Proetus orbitatus*.

The Missouri species, although characterized by a smooth tail, belongs to a different group of the Proetidæ, with only nine thorax segments. The head is parabolic in form. The posterior angles of the movable cheeks are not prolonged into spines, but obtusely rounded. The eyes are similar in location to those of *Phillipsia Sampsoni*, from the same beds. The thorax has 9 pleuræ,



DESCRIPTION OF A NEW SCHIZOPOD FROM LAKE MERCED.

BY SAMUEL J. HOLMES.

[With Plate xix.]

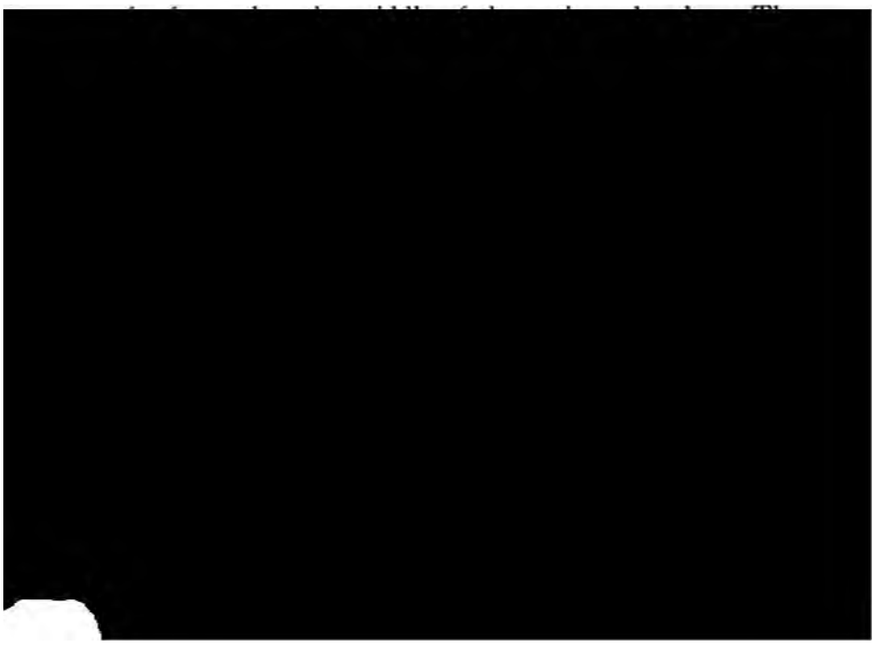
Neomysis mercedis sp. n.

Rostrum rounded. Eyes normal. Outer flagellum of first antennæ much longer than the inner one; sensory organ of the male well developed. Antennal scale narrow, elongate, tapering gradually to an acute tip, and furnished with thickly set plumose setæ on both margins. Mandibles with three short plumose setæ between the cutting edge and molar tubercle; palp large; first joint very small; second joint large and wide, tapering from near the middle to the distal end; third joint narrower and somewhat shorter than the second, the sides parallel up to a short distance from the tip, which is furnished with a large, incurved seta. The distal portion of the exopod of the maxillipeds is divided into eight articulations. The endopod of the following pair of appendages is longer than that of the maxillipeds; the terminal joint is oblong, entire, and bears a large, terminal, claw-like seta; distal portion of the endopod divided into nine joints. The endopods of the succeeding appendages are larger and more slender than those of the former pair, and the terminal segment is long, narrow, incurved, and divided into 8–10 setiferous articulations, the terminal one of which is furnished with a claw. In the male all the pleopods, except the fourth pair, are simple and rudimentary, as in the female, but each bears a small, stump-like process on the inner side, near the base, which may represent the rudiment of an endopod. In the fourth pleopod of the male the endopod reaches about the middle of the slender, elongated exopod; the terminal joint of the exopod is short, and bears two large, sparingly plumose setæ at the tip. Telson shorter than the inner ramus of the uropods, but about equaling the length of the preced-

ing abdominal segment. The margins are furnished with several irregularly spaced spines, and the tip is slightly emarginate. The inner ramus of the uropods is expanded at the base, where the auditory organ is located, whence it tapers to an acute tip. The outer ramus is much longer than the inner one, the sides sub-parallel to the rounded tip; both sides of both rami are furnished with long, plumose setæ.

The specimens (in alcohol) were almost colorless, with the exception of several large, irregularly branching pigment spots. Length of largest specimen ½ in.

The specimens upon which this species is founded were collected at Lake Merced, California, October, 1895, by Dr. H. P. Johnson, to whom I am indebted for the opportunity of making this description. There were thirteen females and but one male in the collection. One female had the marsupial pouch filled with young embryos; the other females were mostly of smaller size, with the marsupial lamellæ undeveloped. This species is closely allied to Murdoch's *Mysis rayii*, from northern Alaska. It differs, however, in the form of the rostrum, which is not quadrangular but rounded, and does not extend nearly so



NOTES ON FISHES, LITTLE KNOWN OR NEW TO SCIENCE.*

BY DAVID STARR JORDAN.

(With Plates xx-xliii.)

The present paper is made up of descriptions of new species of fishes, with notes on little known forms. The material examined, unless otherwise stated, is in the Museum of the Leland Stanford Jr. University, and most of the species referred to belong to the fauna of the Eastern Pacific.

In this paper the following new genera and species are mentioned for the first time:

Zaprora Jordan.
Zaprora silenus Jordan.
Salmo gairdneri crescentis Jordan & Beardslee.
Salmo gairdneri bairdsleei Jordan & Seale.
Umbrina sinaloæ Scofield.
Emmydrichthys vulcanus Jordan & Rutter.
Cottus annæ Jordan & Starks.
Cottus shasta Jordan & Starks.
Tarandichthys Jordan & Evermann.
Oligocottus borealis Jordan & Snyder.
Ulca Jordan & Evermann.
Eleotris abacurus Jordan & Gilbert.
Clevelandia rosæ Jordan & Evermann.
Brysseteres Jordan & Evermann.
Arbaciosa Jordan & Evermann.
Rimicola Jordan & Evermann.
Starksia Jordan & Evermann.
Exerpes Jordan & Evermann.
Chasmodes jenkinsi Jordan & Evermann.
Sebastodes eigenmanni Cramer.
Sebastodes gilberti Cramer.

The accompanying plates are drawn by Miss Anna Louise Brown.

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*Contributions to Biology from the Hopkins Seaside Laboratory. No. 5.

Zaprora silenus Jordan.

Through the courtesy of Mr. Ashdown H. Green, President of the Natural History Society of Victoria, in British Columbia, and of Mr. John Fannin, Curator of the Provincial Museum of British Columbia, at Victoria, I have been allowed to examine the large fish to which I have given the name of *Zaprora silenus*. This specimen, twenty-nine inches in length, was taken in the harbor of Nanaimo, on Vancouver Island. It represents a new genus, allied to *Icosteus*, *Icichthys*, *Schedophilus*, *Acrotus* and *Centrolophus*, but in its combination of characters it is so different from all of these that I have been obliged to give it separate family rank. The definition of the family *Zaproridæ* may for the present be that of the single known genus, *Zaprora*.

Family ZAPRORIDÆ.

Zaprora Jordan, n. g.

Body robust, moderately compressed, the back not elevated, the belly not carinate. Body covered with small adherent cycloid scales, which cover the membranes of all the fins except the distal third, as also the gill membranes, lower jaw, cheeks, opercles and nuchal region.

edge; no teeth on vomer, palatines or tongue, the tongue very thick. Lower pharyngeals narrow, with bluntish teeth, those on the edge larger; upper pharyngeals rather large, with small, blunt velvety teeth; no distinct tooth-like processes in the œsophagus; pseudobranchiæ present; gill-rakers very slender and flexible, rather short; gills four, a large slit behind the fourth; gill membranes separate, free from the isthmus; opercle adnate to shoulder girdle above its angle; coracoids not largely developed. Pectoral fin long, rounded, attached a little nearer ventral than dorsal outline; ventrals wholly wanting. Dorsal fin beginning above gill opening, composed entirely of simple inarticulate rays or spines, these moderately flexible, attached to the membrane to their tips, and all except the first and last of about equal length. Caudal peduncle short and stout, not contracted, the large caudal subtruncate or rounded at tip, and without procurrent rays; vent nearly median. Anal much shorter than dorsal, somewhat higher, and composed of soft rays, subequal in length. Skeleton rather limp and flexible, but much less so than in *Icosteus*.

Type *Zaprora silenus*, n. sp.

This genus bears some resemblance to *Icichthys*, but differs in the stout caudal peduncle, absence of ventrals and lateral line, and in the form and structure of the head. Among the genera known to me it seems to come nearest to *Icichthys*, and it might be placed among the *Icosteidæ*, were it not for the presence of pharyngeal teeth. I therefore place it provisionally in a distinct family, *Zaproridæ*, having at present the characters of the single known genus.

1. **Zaprora silenus** Jordan, n. sp. Plate xx.

Head $5\frac{2}{3}$ in length to base of caudal; depth $4\frac{1}{3}$. D

LVI; A. 27; P. 20 to 22; C. 22; scales about 200–85. Greatest thickness of body about $\frac{2}{5}$ its depth; length of caudal peduncle $1\frac{2}{5}$ in its least depth, which is $1\frac{9}{10}$ in head. Eye $5\frac{1}{3}$ in head; snout $5\frac{1}{3}$; interorbital space 3; maxillary $2\frac{3}{4}$, ending under front of pupil; mandible $2\frac{1}{2}$, its depth $4\frac{2}{3}$; teeth about $\frac{6}{10}$ on each side; lips, snout, and bones about eye naked; rest of head covered with small scales. Lower jaw with a thick lip slightly fringed on its edge, and with a mesial frenum; the rounded tip entering the profile when the mouth is closed. Three large pores on each ramus of mandible; behind these three others in a line on horizontal limb of preopercle; three on vertical limb; two close together in front of eye; one near the nostrils, so similar to them that there seems to be three nasal openings; seven on suborbitals; four in two rows behind eye; one above eye, and before upper edge of preopercle; a horizontal row of five along temporal region, the last and largest of all in opercular flap above gill opening; one at vertex; one between vertex and eye and two on each side of nape. Gill-rakers 8+20, the longest half eye. No trace of lateral line. Scales small, resembling those of a salmon, covering the membranes of all the fins on the basal two-thirds. Pectoral as long as

stuffed, and its form has been somewhat distorted. The form it now has is shown in the plate. In life it may have been more symmetrical, the back higher and the body deeper.

The type specimen was sent to the Provincial Museum at Victoria by Mr. H. T. Stainton of Nanaimo, who gives the following account of it in a letter to Mr. Ashdown H. Green, under date of Nanaimo, January 25, 1896:

"In reply to your favor of the 21st instant, which I have delayed answering in order to get the information you desire regarding the fish I sent to the museum. Mr. G. Marsh, a fish dealer, who gave me the fish, says it was caught on the 21st October, 1895, in the Straits of Georgia, a short distance north of Entrance Island Light-house [about three miles from Nanaimo—A. H. G.], by a fisherman named W. Crocker (who was fishing for cod-fish at the time), with a hand-line and hook baited with a piece of dogfish, in a depth of 150 feet of water. The inside, which was taken out by Mr. Marsh, was the same as that of the codfish (*Sebastodes*), and contained what appeared to be a jelly fish. When Mr. Marsh got the fish from the fisherman, it might be said to be still alive, and at that time the holes in its head were more distinct and the coloring around them of a deeper and richer lemon color than when it was packed for shipment to the museum."

Family NEMICHTHYIDÆ.

2. Nemichthys avocetta Jordan & Gilbert. Plate xxi.

Jordan & Gilbert, Proc. U. S. Nat. Mus., 1880, 409. Port Gamble Wash.

In the same collection of the Provincial Museum at Victoria is a fine specimen of *Nemichthys avocetta*, the second specimen known. This was taken on the beach

at Beacon Hill, near Victoria, by Mr. Norgate, in 1894, and sent to me for examination by Mr. Fannin. This agrees with the description of the original type, the slight differences separating that from *Nemichthys scolopaceus* of the Atlantic being constant. A generic character of *Nemichthys* not heretofore noticed is the division of the dorsal rays into two sorts, near the middle of the body, the anterior series being much longer than the others, and all being undivided or spine-like. This character is shown in the accompanying plates, taken from the Nanaimo specimen. This character does not exist in the related genus *Avocettina*.

3. Avocettina gillii (Bean). Plate xxi.

Labichthys gillii Bean, Proc. U. S. Nat. Mus., 1890, 45. Prince of Wales Island, Alaska.

For purposes of comparison, I present a figure of *Avocettina gillii*, from a specimen (No. 679, L. S. Jr. Univ.) taken by the Albatross at Station 2860. The genus *Avocettina* differs from *Labichthys* and *Nemichthys* in the backward position of the vent, and there is no division in the dorsal rays like that seen in *Nemichthys*.

myself forced to agree with Admiral Beardslee in the opinion that each of these forms is distinct from any previously recorded or named. The two are allied to each other, rather than to any other form, and the nearest affinities of both seem to be with the steelhead trout (*Salmo gairdneri*) rather than any other. But placing the two as subspecies of *Salmo gairdneri* is simply a provisional arrangement, and there is just as good warrant for regarding each as a distinct species.

From all forms of *Salmo gairdneri* both the new forms differ in the large size of the head as well as in coloration and in the form of the snout and opercles. The size of scales, the form of the gill-rakers, the form of the opercle, the form of the pyloric cœca, the outline of the caudal, and the coloration, are different in the two forms.

4. **Salmo gairdneri crescentis** Jordan & Beardslee, n. subsp. SPECKLED TROUT OF LAKE CRESCENT. Plate xxii.

Head $3\frac{4}{5}$ in length to base of caudal; depth 5; exposed portion of eye 6 in head, $1\frac{2}{3}$ in snout; scales 32–151–34, 151 cross-series, 83 in front of dorsal; dorsal with 10 branched rays, anal with 11; branchiostegals 10; gill-rakers 6+11, counting rudiments, these very short and thick, the longest but $\frac{3}{16}$ inches in length, $18\frac{1}{2}$ in maxillary; mouth large, maxillary extending much beyond eye, $1\frac{2}{3}$ in head, with about 20 teeth; tongue with the usual teeth; teeth on vomer in zigzag series; hyoid region of tongue without teeth. Snout $3\frac{1}{2}$ in head; preorbital very narrow, not so wide as maxillary adjacent to it; the posterior suborbitals longer than eye, $5\frac{1}{3}$ in head; opercle and subopercle very narrow, scarcely as wide as eye, the free part of opercle $6\frac{1}{3}$ in head; interorbital width $4\frac{1}{4}$ in head. Origin of dorsal in middle of length of body, its margin straight, anterior $2\frac{1}{2}$ times posterior, and slightly

longer than base, 2⅓ in head. Last ray of dorsal pointed. Origin of anal midway between origin of dorsal and base of caudal, margin irregular, anterior rays three times length of posterior, and equal to base of fin, $2\frac{2}{3}$ in head. Adipose fin high and slender, situated immediately behind anal. Pectoral $1\frac{4}{7}$ in head. Ventrals under middle of dorsal, $2\frac{3}{8}$ in head. Caudal broad, slightly emarginate, nearly truncate when spread, its corners not rounded, its longest rays 1½ in head. Least depth of caudal peduncle $3\frac{3}{7}$ in head. Pyloric cœca about 51, the longest about $1\frac{5}{6}$ in head, and very slender. Color in alcohol very dark steel blue above, becoming paler below, nearly white anteriorly on belly where only the margins of the scales are punctate; no silvery anywhere; lower jaw dusky, a large black blotch on cheek between suborbital and premaxillary. Sides, back, top of head, dorsal and caudal fins with few small dark spots; pectorals dusky, slightly spotted at base; anal slightly dusky, without spots; ventrals dusky with a few spots in middle; adipose fin with a few spots; lower fins all tipped with pale, probably yellowish red in life. Spots all very small and faint, not confined to posterior part of body.

waters are very cold. Its water supply comes in large part from the snow from the mountains which rise from its shores in great majesty and almost completely surround it. The fishing there is really magnificent, especially fly-fishing. Several varieties of trout abound, but the blue-back is the handsomest and gamest fish in the lake. They afford one great sport. Those that the Admiral took measured from twenty-eight to thirty-two inches in length, and averaged about ten pounds each in weight. He has doubtless furnished you with exact data regarding his fine catch there."

5. **Salmo gairdneri beardsleei** Jordan & Seale, n. subsp.
BLUE-BACK TROUT OF LAKE CRESCENT. Plate xxiii.

Head $3\frac{4}{5}$ in length to base of caudal; depth about 4; eye $4\frac{5}{6}$ in head, $1\frac{2}{3}$ in snout; scales 24–130–20, 130 cross series, those in front of dorsal numerous, about seventy if counted along median line, sixty if the rows along upper side are counted; dorsal with 10 branched rays; anal with 11 branched rays; branchiostegals 11; gill-rakers 8+13, rather long and slender, the longest nearly $\frac{5}{16}$ inch in length, 7 to 9 in maxillary. Head pointed; mouth rather large; maxillary extending to hinder margin of eye, $1\frac{4}{5}$ in head, with about 20 teeth; snout $3\frac{3}{5}$ in head; preorbital very narrow, the maxillary almost touching the orbit; posterior suborbitals shorter than eye, about 6 in head; opercle not very broad, equal to eye, its free part $4\frac{5}{6}$ in head; interorbital width $3\frac{3}{5}$ in head, equal to snout; several large teeth along margin of tongue; no hyoid teeth; teeth on vomer in zigzag series. Origin of dorsal in middle of the length, margin slightly concave, the first ray $1\frac{5}{6}$ times last, the last ray being pointed, slightly greater than base, $2\frac{1}{10}$ in head. Origin of anal midway between origin of dorsal and base of caudal, margin straight, the tip of the last ray slightly exserted; anterior

rays 3¼ times posterior, and equal to base of fin, 2⅓ in head. Adipose fin high and slender, situated above or anterior to end of anal. Pectorals 1½ in head; ventrals under middle of dorsal, 2⅓ in head. Caudal broad, nearly truncate, the middle portions abruptly lunate when spread open, with pointed angles, each lobe being somewhat convex on its edge; longest rays 1⅓ in head. Least depth of caudal peduncle 2¾ in head. Pyloric cœca 50 to 60, short and thick, the longest about 3 in head. Color in spirits very dark blue above, sides abruptly brighter, with many scales abruptly silvery; below white, lower jaw white, its margin dusky; cheeks below suborbitals very dark; sides, top of head, dorsal and caudal fins spotted, the spots all very small; pectorals and ventrals nearly colorless, without spots, and slightly dusky; adipose fin with two spots; tips of lower fins faintly tinged with yellowish.

Two specimens, each 16 inches long, Nos. 1861 and 1862, L. S. Jr. Univ. They were taken on March 12 and 16, 1896, in Lake Crescent, by Mrs. George E. Mitchell of Fairholme, and sent to us by Mr. M. J. Carrigan of Port Angeles. No. 1864, L. S. Jr. Univ.

A third specimen of much larger size, afterwards sent to us, shows the following characters:

on body, extending to below lateral line; many small spots on head, dorsal and caudal; spots not more numerous behind than before; sides and belly bright silvery; no red on lower jaw; a faint pink shade along lateral line; pectorals colorless except the upper ray; ventrals and anal colorless; flesh pale; gill-rakers removed.

This specimen, male, was taken in Lake Crescent. Length 26½ inches; weight in life 14 pounds.

This specimen differs from a large *gairdneri* most in the large scales. In addition the head is much larger, and the body deeper.

A fourth still larger specimen (No. 1865, L. S. Jr. Univ.), an old spent male, 27 inches long, has been still later received. It shows the following characters:

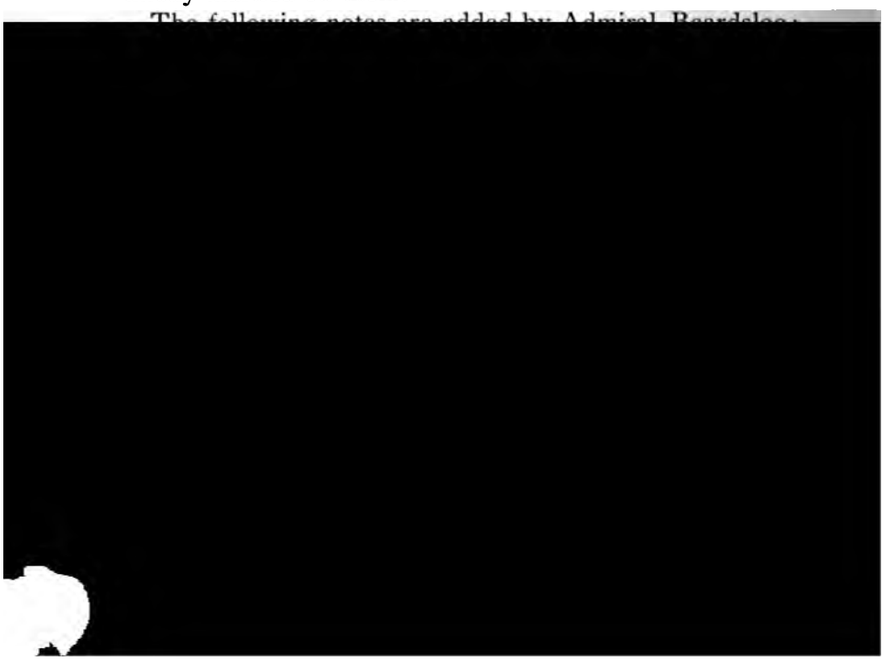
D. 11; A. 12. Head $3\frac{3}{5}$ in length. Gill-rakers 8+12, of medium size, rather broad but sharp pointed; opercle 3½ in head; eye 7 in head; B. 11. Maxillary long, reaching beyond the eye, 1⅔ in head, its width 9½ in length. A double row of sharp teeth extending to within a short distance of end, where they are replaced by a single row of slightly larger teeth; teeth on tongue rather large; no teeth on hyoid; teeth on vomer in zigzag series. Scales 26–137.

This specimen, a spent male, has the flabby muscles and slimy half concealed scales of the spent male salmon. The dark dots are very numerous and small and show very distinctly on back and sides, as also on head and fins. There is a dull red lateral band on head and body. This is about an inch broad, its outlines diffuse: A black blotch on cheek; maxillary dusky with a red blotch toward its tip. Lower jaw and branchiostegals dusky; pectoral, ventral and anal dark; back dark green, belly dusky.

The following account of the life-coloration of *Salmo beardsleei* is given by Mr. George E. Mitchell.

" The Blue-back Trout caught in Lake Crescent are on the back a deep dark-blue ultra-marine color of a peculiar transparency, dotted with small round black spots from the size of a pin's head to a little larger. The two fins on the top of the back are a dark smoky color, also dotted as on back end and are transparent. The tail is the color and transparency with dots also—same as the top fins. The side fins and the bottom fins are dead white and sometimes faintly tinged with a pinkish hue at the edges; the belly is white. Looking at the fish sideways the sides of the fish show the scales to be iridescent, the red flash predominating. The head has very much the polish of mother-of-pearl around the lower jaws and jowls, red and pale blue colors predominating; under the eyes a few black spots; on top of head the blue much darker than on top of back—so dark in fact that the black spots on it look blacker than the rest. The nearer the shore these fish are caught the lighter the blue on back, the fish often having an impression of the surroundings distinctly marked on them."

The following notes are added by Admiral Beardslee:



BLUEBACKS FROM LAKE CRESCENT, WASHINGTON.

L. A. BEARDSLEE. 6 11½ 11 11½ M. J. CARRIGAN.

TWO HOURS' WORK, OCTOBER 28, 1895.

FLESH.

Light lemon color before cooking; devoid of the oily salmon flavor, and very excellent; whitening by cooking.

OVA.

October 28—The eggs in the large fish were in *individual* size, and in size of cluster much smaller than those of a salmon of the same size.

The following extracts from a letter from Mr. Carrigan, dated Port Angeles, April 30th, are of much interest:

* * * Answering your direct inquiries: The Beardslees and Crescents are readily distinguishable, and can always be told apart.

There are no red spots at the points indicated on the Crescent trout—no markings to suggest the Cut-throat trout.

There are no Cut-throat trout in Lake Crescent.

The Beardslees (Bluebacks) are taken in deep water. Those caught by the Admiral and myself were taken in from 25 to 35 feet of water.

The known varieties of trout in the lake are:

(a) "Beardslees."

(b) "Crescents."

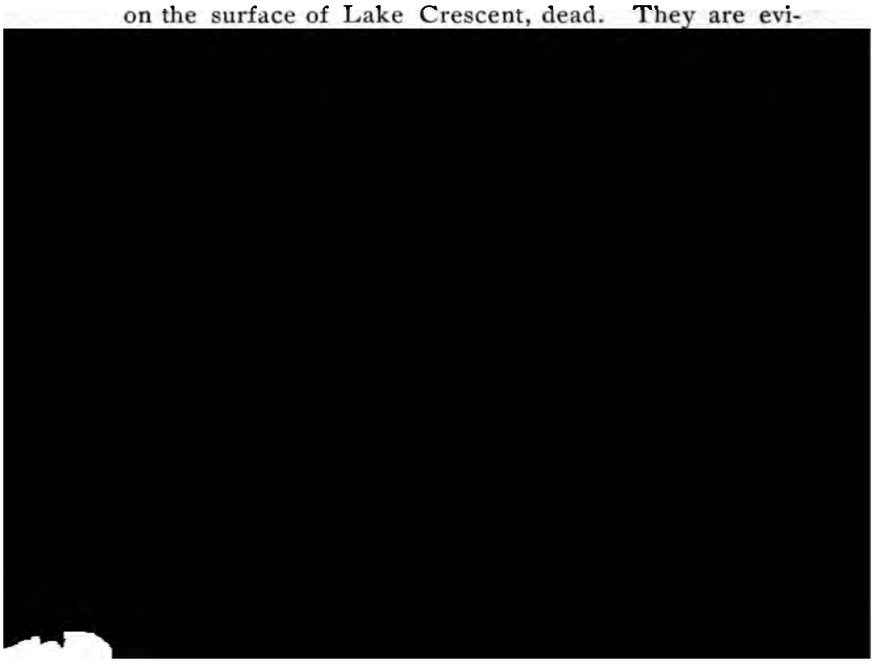
(c) "Silvers" (the local name for a very beautiful trout, that measure, as a rule, from 12 to 18 inches in length; but I have seen specimens 22 inches long, and there are doubtless much longer ones in the lake).

(d) "Half-breeds" (the local name for a long, slender, graceful trout, that seems to be a cross between the Beardslees and Crescents. The markings of the fish, as I recall them after last season's fishing, are a rather pale olive-green back and silver sides; the head and back being dotted with rather faint small black spots. The shape of the fish is one of its distinctive features. The flesh is pale lemon colored).

(e) "Mountain trout" (a variety that evidently comes into the lake from the mountain streams that empty into it).

The possibilities of the beautiful mountain lake have never been fully tested. The Admiral (Beardslee), when he comes up in June, will fish it at all depths, and there is no telling what new surprises he may bring forth. The lake is about 10 miles long by 2 or 2½ miles wide, and deep water is found everywhere close to shore. In places a 500 foot lead-line will not sound bottom. No one really knows what depths of water exists in the lake beneath the 500 foot sounding, or what size or variety of trout can be taken at depths lower than those so successfully tried by Admiral Beardslee. But we will know this season; and you will be promptly acquainted with everything new or of interest that is brought forth.

* * * High up on the side of one of the mountains surrounding the lake—probably 2,500 or 3,000 feet above the lake—is a pretty little lake containing what I believe will also prove a new variety of trout. Specimens of the variety are found every spring, after the freshets caused in the mountain streams by melting snow, floating on the surface of Lake Crescent, dead. They are evi-



In a letter to Admiral Beardslee, dated April 19th, Mr. Carrigan gives these further details, especially interesting to the angler:

* * * I have some news that will interest you. We have a young lady friend visiting us—Miss Sara Beazley of Columbia, Missouri. On Friday, the 17th inst., Mrs. Carrigan and Miss Beazley drove out to Lake Crescent to spend a few days with Mrs. Mitchell. They returned in triumph at 4 o'clock this afternoon, with four trout weighing 21 pounds.

Miss Beazley, Mrs. Mitchell and Mrs. Carrigan went out fishing at 10:30 yesterday, Saturday morning, April 18th. They took the copper wire troll that you sent to Mrs. Mitchell and Miss Beazley did the fishing, using trout belly for bait. When off Eagle Point, at 11:30, Miss Beazley caught and successfully landed a magnificent speckled trout that measured 27 inches in length, was 6 inches through, and weighed 8 pounds. The top of the head and back of the fish is a dark blackish green, the head and back being thickly covered with quite large round black spots which extend down the sides about halfway to the median line. From there to the median line the black spots are equally thick, but are irregular in form, two and sometimes three spots lapping on to each other, making angular looking black spots of various sizes, some of them quite large. The irregular spots extend in a scattering way below the median line. The tail is thickly marked with round black spots.

The upper jaws and gill plates have the appearance of clouded reddish mother-of-pearl, somewhat iridescent. In some lights the "reddish" shade has a burnished copper effect, and in other lights it presents a pale ma genta shade. There are six large round black spots on each side of the head, on the upper and back portion of

these mother-of-pearl plates (on a line back of the eyes). The back fins are blackish green, heavily dotted with round black spots. The side and belly fins are of smoky gray, opaque, and entirely free of spots.

Miss Beazley had a great struggle landing the fish. It made a fine fight, towing the boat for a long distance. She landed him without a gaff-hook.

About an hour later in the same locality Miss Beazley caught a one-pound Bearsdslee. The party then went home to luncheon, and at 4:30 started out again, Miss Beazley still managing the troll, and Mrs. Mitchell managing the boat. At 6:30 o'clock, when off Eagle Point, Miss Beazley caught and landed (without a gaff, also) a superb Beardslee that measured 29½ inches in length and 8 inches through, and weighed strong 10 pounds. It was a beautiful specimen and made a fierce and prolonged fight. It raced along with the boat (the wind slight favoring its "tow") for a long distance below the point, and made several desperate and out-of-the-water leaps and plunges to get away; but it had swallowed the hook and was securely caught. As soon as it struck the bottom of the boat, on being taken over the side, it began a terrific struggle to get back into the water, and

freshened into a strong breeze, and were taken in from 30 to 35 feet of water. The women followed the plan of rowing along slowly; stopping rowing altogether for a few seconds, and then starting off again slowly. Both fish were taken just as the boat started up, after one of three brief stops, during which the troll had gone down to a greater depth than when the boat was in motion.

I examined the Beardslees with great care just after the women reached home this afternoon, and have settled these points definitely:—The head is densely spotted with round black spots down as far as the mother-of-pearl gill plates, but no further. There are no black spots on these plates. The blue on the back extends down almost to the median line, and the entire back, from head to tail, and on either side halfway down to the median line, is thickly marked with round black spots which decrease in size as the tail is approached. The tail itself is densely dotted with round black spots, as are also the back fins. The side and belly fins are not spotted. The black spots on the back are not so prominent as on the smooth surface of the head, owing to the presence of the scales on the back and sides, but they are there in great numbers.

I noticed this difference between the marking of the one-pound and the ten-pound Beardslee. On the one-pound fish there is a well-defined line of large round dark spots extending the whole length of the body, from a point just back of the gills to the tail fin, and midway between the median line and the bottom of the belly. There are 17 of those spots grading down in size. These spots are not a pronounced black, but show out plainly enough from beneath the whitish silver scales, presenting the dark dull appearance of human flesh

bruised by a blow. These spots are entirely absent from the ten-pound Beardslee.

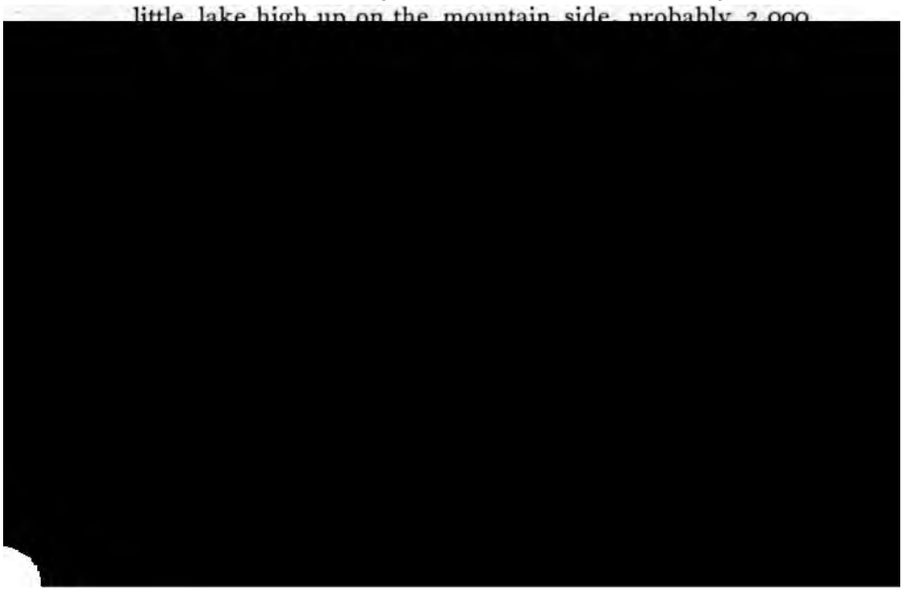
* * * On Friday, April 17th, just before Mrs. Carrigan and Miss Beazley arrived at the lake (it was about 6 o'clock in the afternoon) Mrs. Mitchell caught, with the gear you sent her, a twelve-pound Beardslee, measuring 30 inches in length and 8½ inches through. She is immensely proud of your gift, which is doing such splendid work so early in the season.

These fine catches made by the ladies prove the possibilities of the lake in early spring; your own splendid success demonstrates what can be done late in the fall, at the very tail end of the season. It remains for you to show what can be done in the heat of the season. There is no knowing what surprises may result from the deep fishing that you will do this summer, for I know that you will give the lake a thorough test at all depths.

It would be a good idea to take out, when you go there this summer, a proper rig for sounding the lake, which has never yet been sounded.

It is my conviction that you will shatter your own big trout record all to pieces this summer, and give the fishing world a series of fresh surprises.

* * * The Eagle Point stream has its origin in a little lake high up on the mountain side, probably 2,000



gives further notes of interest concerning the third specimen described above:

I have just forwarded to you a 14-pound "*Crescent Lake trout*" (the Blueback), which was caught at Lake Crescent, Sunday afternoon, by Mr. Ben. Lewis. This trout, when taken from the water, weighed full 14 pounds, measured 32 inches in length and 8½ inches in width. Mr. Lewis at once started for Port Angeles, to present the trout to me to be forwarded to you, for I had told him that I was anxious to send you a large specimen of the Crescent trout, that you might note its special characteristics. He rowed over the lake, 8 miles, and walked into Angeles, 20 miles more, carrying this trout on his back, arriving here at midnight. We were both desirous of getting the fish off to you as promptly as possible and in the best condition, but it was impossible to get any ice here yesterday, and we had to keep the trout as best we could until the ice we telegraphed for arrived from Seattle to-day.

It is a magnificent specimen of the "*Salmo beardsleei*," and certainly presented a splendid appearance when first unrolled from Mr. Lewis' pack-sack. It was then sweet, fresh and plump. I hope it will reach you in good condition. We packed it carefully in ice before sending it forward.

It is a pity that we cannot get one of these fish to you, showing its beautiful life coloring. When freshly taken from the water the head and back of the trout is a very deep, rich blue, which extends well down to the median line, and below the median line all is gleaming, creamy white, with a sheen as bright as burnished silver, and iridescent. The head, back and tail are strongly marked with black spots.

The beautiful blue coloring of the back fades out after

death and loss of blood, and changes to a shade of silvery green. I don't know what the fish look like when they reach you, but they have lost their royal coloring before they leave here.

Mr. Lewis has just told me of an entirely new variety of trout that he catches in the lake, at a depth of from 80 to 100 feet. He takes them on set lines, which he places out over night, and says he has never been able to catch one of this species in any other way. He says it differs from any other trout in the lake; that it is a long, slender, graceful and very attractive fish, with a grayish green back and below the median line, pure white sides and belly. He has promised to secure a specimen of this variety for me to be sent to you.

Family LUTIANIDÆ.

6. Xenocys jessiæ Jordan & Bollman. Plate xxiv.

Xenocys jessiæ Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 160. Charles Island, Galapagos.

The figure of this handsome species is taken from one of the original types.

Family SCIÆNIDÆ.

7. Umbrina sinaloæ Scofield, n. sp. Plate xxv.

Head 3 [illegible]; depth 3 [illegible]; eye 3¼ in head; snout 3¼;

above (greenish in life), silvery below; a dark blotch on opercle; conspicuous dark olive stripes follow the center of the scale rows upward and backward on the sides and back; stripes about ½ as wide as pupil; spinous dorsal dusky; ventrals and anal pale, without punctulations; lining of gill cavity quite dark; gill membranes pale; peritoneum pale.

Resembles *Umbrina xanti* very closely; but is distinguished by the dark gill cavity, the small scales, small second anal spine, and more anterior position of anal. The stripes on the body are slightly darker, not so undulating, and there are a few more of them, due to the smaller and more regular scales.

Length 8 inches.

Type No. 1632, L. S. Jr. Univ. Mus., collected at Mazatlan by the Hopkins expedition of 1894. Several specimens were obtained in company with *Umbrina xanti*. It is equally abundant, having been hitherto confounded with the latter species. I may note that specimens of the Californian species, *Umbrina roncador*, are in the collection from Guaymas.

Family SCORPÆNIDÆ.

8. **Emmydrichthys vulcanus** Jordan & Rutter, n. gen. and sp. Plate xxvi.

Generic description:

Body short and stout, length of head about equal to depth; body with no scales, thickly covered with irregular dermal prominences. Cleft of mouth vertical. A band of minute depressible teeth in each jaw, none on vomer or palatines. Tongue free, short and broad. Opercles unarmed, covered with thick loose skin. Gill openings very long. Eyes with an almost vertical range, the interorbital space very deep, a large pit behind and

one below each eye. Dorsal divided by a deep notch, the anterior part with nine, the posterior with two spines; anal with three. Anterior spines of dorsal each with a pair of antero-lateral grooves.

The new genus *Emmydrichthys* is closely related to *Synanceia* Bloch, differing in having the dorsal divided and with a smaller number of spines, and in the presence of a deep pit or groove below eyes.

Head 2⅓ in length, depth 2⅓. D. IX–II, 7; A. III, 6; P. 18. Gill opening extending forward almost to below mouth, almost as long as depth of body. Head with many pits and irregular protuberances. Eyes situated on the outer sides of a pair of protuberances, the interorbital space very deep and nearly smooth, a large cavity behind each eye and a smaller one below. A small papilla on upper side of eyeball. Jaws equal, fringed with cirri. Anterior nostril tubular. Dorsal fins connected at base. Fin membranes all thick and heavily papillose, greatly thickened around anterior dorsal spines. Eyes midway between snout and origin of dorsal. Middle dorsal spines slightly longest, about equal to distance of first spine from pupil; longest pectoral rays, third and fourth from top, equal to distance of dorsal from tip of lower jaw; anal not

museum of California College, Oakland, by Rev. J. H. Henry of Tahiti. It was said to have been taken at the Hawaiian Islands. By the courtesy of Professor Inskeep of this institution we have been permitted to examine this type. The species is called by the natives No-ho, and its poisonous dorsal spines cause it to be greatly dreaded.

Family COTTIDÆ.

9. Cottus annæ Jordan & Starks, n. sp. Plate xxvii.

Head 3½ to 3¾ in body, depth 5. D. VII or VIII–16 or 17; A. 12; eye 5 in head; maxillary 3⅔; highest dorsal spine 3½; highest soft ray 2; pectoral 1; ventral 1⅔; caudal 1¼.

Body elongate, not much compressed; caudal peduncle wide, wider than length of snout. Head small, broadly rounded anteriorly as viewed from above; snout blunt as viewed from the side; mouth very small, without so much lateral cleft as in *Cottus beldingi* or *C. philonips*, the maxillary reaching to front of pupil; teeth in moderately wide bands on jaws and vomer; palatines toothless or with a few teeth in a narrow band on front; interorbital (bone only) equals ½ eye; eye smaller than length of snout; preopercle with only one small blunt spine, below which its edge is entire. Pectoral barely reaching front of anal; spinous dorsal very low, from ½ to ⅔ as high as soft dorsal, its base from its first spine to first ray of soft dorsal 1¼ in head; dorsals barely meeting, not at all connected.

Color light gray, somewhat mottled; ventrals and anal colorless, other fins crossed with wavy lines; a black spot on each end of spinous dorsal.

We have compared these specimens with specimens of *Cottus beldingi* from Birch Creek, Idaho, and from other localities as also with a single type specimen of *Cottus*

philonips from Field, B. C. It differs from both of these in having the mouth and eyes smaller, and from the Field specimen in having a deeper body.

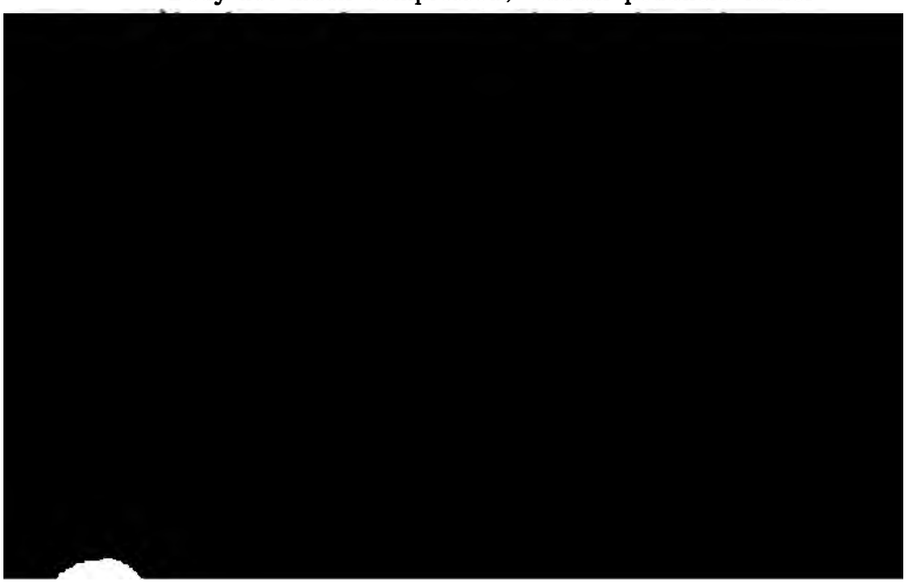
Here described from four specimens from 2½ to 3½ inches in length, collected at Gypsum, Colorado, from the Eagle River, by Jordan, Evermann, Fesler and Davis, Nos. 1305, 1308, 1309 and 1310, L. S. Jr. Univ. Mus. It has hitherto been confounded with *Cottus semiscaber*, which was taken in abundance at the same place, and recorded in their report as "*Cottus bairdii punctulatus.*" The species is named for Miss Anna Louise Brown, artist of the Hopkins Laboratory.

We may here note that *Cottus philonips* is very doubtfully distinct from *Cottus beldingi*, the only difference we can find being in the deeper body of the latter, which is a widely distributed species. Of *Cottus philonips* only the types are yet known, the Alaskan specimens referred to it being quite distinct.

10. **Cottus shasta** Jordan & Starks, n. sp.

Head 3 to 3⅓ in body, depth 4½. D. VIII or IX–17 or 18; A. 13 to 15; eye nearly 5 in head; maxillary $2\frac{1}{5}$; third or fourth dorsal spine $3\frac{3}{5}$; highest soft ray about 2; pectoral about $1\frac{1}{10}$; caudal 1¼.

Body not much compressed; caudal peduncle rather



nected, the soft dorsal high, the highest rays equal to eye and snout; vent slightly nearer tail than tip of snout. Skin smooth, except a few scattered prickles under pectorals.

Color very dark brown or blackish; sides mottled; top of head uniform blackish; all the fins more or less mottled, ventrals white or dusky. The following is the fin formula of four specimens:

Dorsal	IX–17;	VIII–19;	IX–17;	IX–18.
Anal	14;	15;	15;	13.

Upper Sacramento Basin; here described from four specimens from McCloud River, Baird, Shasta county, California, about 4 inches in length. No. 4196, L. S. Jr. Univ. Mus. Collector, E. C. Starks.

The species is very close to *Cottus semiscaber*, but it has a longer anal.

11. **Tarandichthys filamentosus** (Gilbert). Plate xxviii.

Icelinus filamentosus Gilbert, Proc. U. S. Nat. Mus., 1890, 85. Off Santa Barbara Islands.

The section of *Icelinus* distinguished by the presence of filamentous dorsal spines, and the presence of bony plates behind the pectoral, represents a subgenus or genus distinct from *Icelinus*. This may be called *Tarandichthys*, Jordan & Evermann. The name (*Ταράνδος*, reindeer) alludes to the antler-like preopercular spine. The accompanying plate is from one of the type specimens of the type-species, *filamentosus*.

12. **Icelinus quadriseriatus** (Lockington). Plate xxix.

We present for comparison a figure of the type-species of *Icelinus* from a specimen dredged off the coast of California.

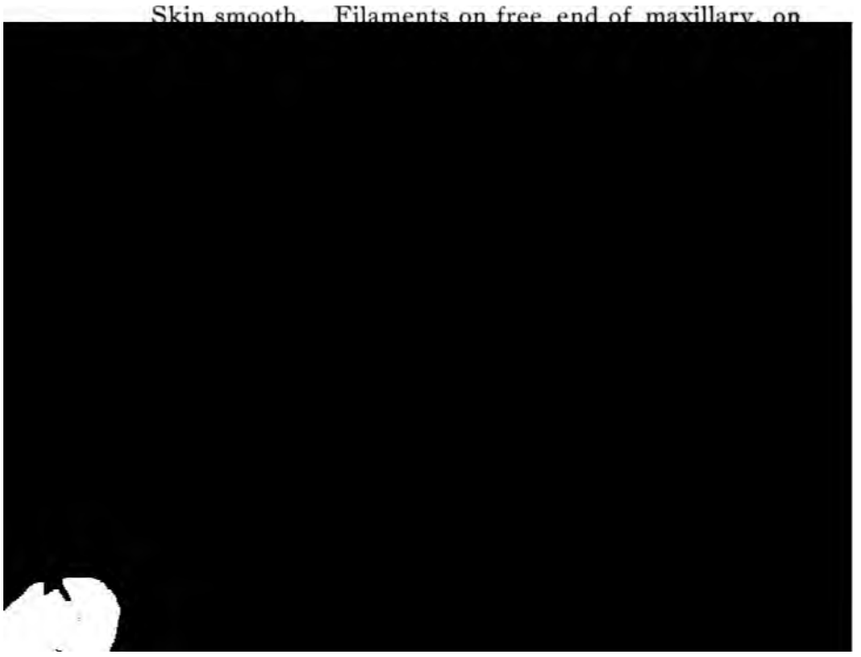
13. **Oligocottus borealis** Jordan & Snyder, n. sp.

Head $3\frac{1}{5}$ in length; depth $4\frac{1}{3}$; dorsal VIII or IX–16

or 17; anal 12 to 14; pectoral 14; orbit 4 in head; snout 4; maxillary $2\frac{4}{5}$; highest dorsal spine 3; dorsal ray $2\frac{1}{2}$; caudal ray $1\frac{1}{2}$; first anal ray ♀ $1\frac{1}{2}$, ♂ 3; ventrals $1\frac{5}{6}$; caudal peduncle $3\frac{1}{2}$; pectorals 3 in length.

Body compressed, elongate; back somewhat elevated, deepest below middle of spinous dorsal. Head almost as wide as long, tapering from behind to the somewhat pointed snout; profile of head rounded above, straight below; mouth terminal, nearly horizontal; maxillary extending to vertical through posterior part of pupil; lower jaw included; jaws, vomer and palatines with villiform teeth; snout as long as orbit; eye high in head; interorbital space narrower than width of orbit; its concavity angular; opercle with a triangular flap; angle of preopercle produced into a forked spine, which is covered with skin, except on the sharp points; prongs of preopercular spine half as long as orbit; nasal spines prominent; the long premaxillary processes form a sharp ridge between the latter; branchiostegal membranes forming a fold across the isthmus; gills $3\frac{1}{2}$, the slit behind the fourth arch much reduced; pseudobranchiæ present; gill-rakers represented by a few protubrances on the arch.

Skin smooth. Filaments on free end of maxillary, on



head and body, a little higher than first, its middle rays longest. Anal fin about 3¼ in head and body; in the male the first and second rays longest, the third, fourth and fifth each a little shorter than the preceding one, the last shortest. In the female the first ray is the shortest. Caudal fin somewhat rounded. The pectoral rays below the sixth are ventrally free from the connecting membrane for a portion of their length. Ventral fins reaching to vent, in some specimens to anal.

Color usually reddish brown, varying to gray, intense green or crimson, according to surroundings, the colors developed in the presence of similarly colored algæ; dorsals, pectorals and caudal barred; anal sometimes barred; front of spinous dorsal with an ocellated black spot.

The types were collected in the tide pools at Neah Bay, Puget Sound, by Mr. E. C. Starks. Very many specimens are in the Leland Stanford Jr. University collection, No. 3396. Others were earlier sent to us by Henry St. Clair of Neah Bay. Still others were taken by Dr. Gilbert at Departure Bay, Vancouver Island.

This species is closely related to *Oligocottus maculosus*, with which it has been hitherto confounded. It is distinguished from the latter by having fewer filaments on the head and body, an ocellated spot on front of first dorsal, and by having the rays of the anal fin in the male all connected by membrane; the first ray of anal is much shorter and weaker in *borealis*.

14. Ulca marmorata (Bean). Plate xxx.

Hemitrepterus marmoratus Bean, Proc. U. S. Nat. Mus., 1890, 43. Sitkalidak Island.

This species differs from *Hemitripterus* in the shorter first dorsal, which does not show the division found in the typical species of *Hemitripterus*. It is the type of the genus, *Ulca*, Jordan & Evermann. The specimen

figured, not a type, is from near Unalaska. Coll., C. H. Gilbert, on the Albatross.

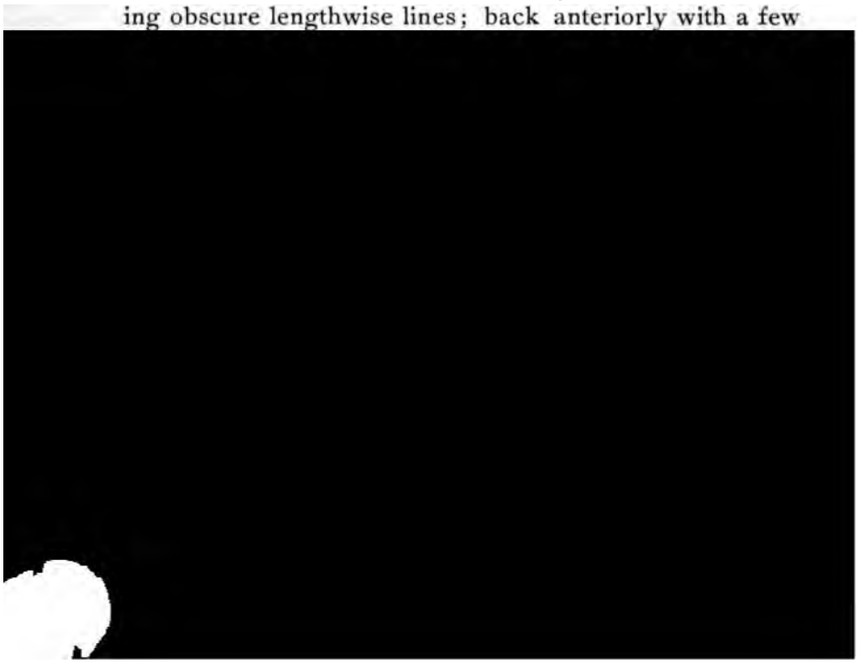
Family GOBIIDÆ.

15. Eleotris abacurus Jordan & Gilbert, n. sp.

Head 3; depth 4⅓. D. VI–9; A. I, 8; scales 51–20; eye 8 in head, 2⅓ in interorbital width; pectoral 1⅓; ventral 1½; highest dorsal ray 2; highest anal ray 2; caudal 1¼.

Body slender, compressed, the head depressed, becoming very narrow anteriorly, its width ⅜ its length; a notable depression above orbits, the premaxillary processes protruding before it; lower jaw the longer; maxillary reaching vertical behind pupil, 2⅜ in head. Teeth in jaws in narrow villiform bands, becoming a single series on sides of lower jaw; those of the outer and inner series in each jaw are somewhat enlarged, the largest being a single series in sides of lower jaw. Preopercular spine as usual in the genus. Scales smooth above and below, ctenoid on sides.

Color in spirits brown, lighter above and below; each scale on middle of sides with a dusky streak, these forming obscure lengthwise lines; back anteriorly with a few



This species agrees very well with Cope's account of *Culius amblyopsis*, but the eye is smaller and there is some difference in color, besides the remote habitat.

16. **Evermannia longipinnis** (Steindachner).

Gobiosoma longipinnis Steindachner, Ichth. Beitr., viii, 27, 1879. Las Animas Island, Gulf of California.

At my request, Dr. Steindachner has re-examined the types of his *Gobiosoma longipinnis*. He finds them completely scaleless, as originally described. The species cannot then be placed in the genus *Clevelandia*, as in Dr. Eigenmann's arrangement, but is nearest to *Evermannia*.

17. **Clevelandia rosæ** Jordan & Evermann, n. sp.

Clevelandia longipinnis, Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 1888, 73. San Diego. Not *Gobiosoma longipinne* Steindachner.

The species described from San Diego by Dr. and Mrs. Eigenmann, under the erroneous name of *Clevelandia longipinnis*, and made the type of the genus *Clevelandia*, must receive a new name. We suggest that of *Clevelandia rosæ*, in honor of Mrs. Rosa Smith Eigenmann, its discoverer.

Family URANOSCOPIDÆ.

18. **Kathetostoma averruncus** Jordan & Bollman. Plate xxxi.

Kathetostoma averruncus Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 163, southwest of Panama.

A figure of this interesting species of Star Gazer is here given from the original type.

Family DACTYLOSCOPIDÆ.

19. **Gillellus semicinctus** Gilbert. Plate xxxii.

Gillellus semicinctus Gilbert, Proc. U. S. Nat. Mus., 1890, 98. Gulf of California.

I present a figure of this interesting species from one of the types.

20. Dactylagnus mundus Gill. Plate xxxiii.

I present a figure of this species from a specimen obtained by Dr. Gilbert while with the Albatross. The genus is a valid one, well separated from *Doctyloscopus*.

Family GOBIESOCIDÆ.

21. Bryssetæres pinniger (Gilbert). Plate xxxiv.

Gobiesox pinniger Gilbert, Proc. U. S. Nat., 1890, 94. Puerto Refugio, Gulf of California.

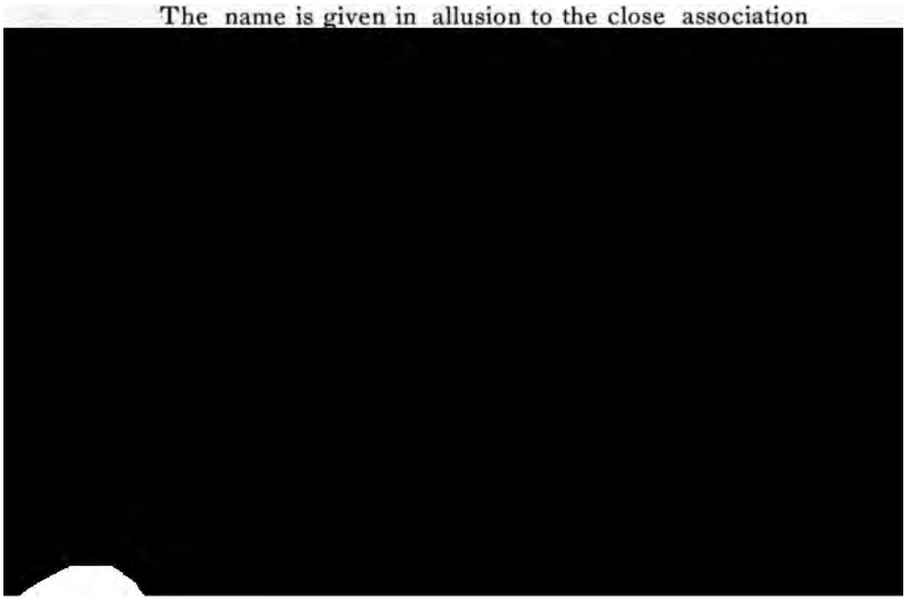
This species is the type of a distinct genus, *Bryssetæres* Jordan & Evermann, distinguished from *Gobiesox* by the long dorsal fin. The vertebræ are 26, as in *Gobiesox*. The plate here given is from one of the type specimens. The name βρύσσος, sea-urchin; ἑταίρος, comrade, alludes to the brotherhood existing between the Clingfishes and the Sea-urchins in the rock pools.

22. Arbaciosa humeralis (Gilbert). Plate xxxv.

Gobiesox humeralis Gilbert, Proc. U. S. Nat. Mus., 1890, 95. Puerto Refugio.

This species, with its allies *zebra*, *eos*, *rhessodon*, etc., differs from *Gobiesox* in the serrated teeth. It may be made the type of a distinct genus, *Arbaciosa* Jordan & Evermann.

The name is given in allusion to the close association



25. Rimicola muscarum (Meek & Pierson).

Gobiesox muscarum Meek & Pierson, Proc. Cal. Ac. Sci., 1895, with plate. Monterey.

This species is distinguished from *Gobiesox* by the narrow body and very small dorsal and anal fins. It may be regarded as the type of a new genus, *Rimicola* Jordan & Evermann. To the same genus, *Gobiesox eigenmanni* Gilbert may be referred. *Rimicola muscarum* has been well figured by Meek & Pierson.

26. Rimicola eigenmanni Gilbert. Plate xxxii.

I present a figure of the type of this species from Todos Santos Bay.

Family BATRACHOIDIDÆ.

27. Thalassophryne dowi Jordan & Gilbert. Plate xxxviii.

Thalassophryne dowi Jordan & Gilbert, Proc. U. S. Nat. Mûs., 1887, 388. Panama.

I present a figure of this interesting species, taken from a specimen from Panama, larger than the original type.

I may notice that *Batrachus* Bloch & Schneider, 1801, is a synonym of *Batrachoides* Lacépède, 1800, and cannot be used as the name of a distinct genus. None of the naked Toad-fishes were known to Schneider. The oldest generic term available for them is that of *Opsanus* Rafinesque, *Opsanus cerapalus* is identical with *Batrachus tau*, which must stand as *Opsanus tau*.

Family BLENNIIDÆ.

28. Starksia cremnobates (Gilbert).

Labrisomus cremnobates Gilbert, Proc. U. S. Nat. Mus., 1890, 100. Gulf of California.

This pretty species seems to be the type of a distinct genus, *Starksia* Jordan & Evermann, distinguished from *Labrisomus* by the large scales, presence of palatine teeth, the short, soft dorsal and the absence of the comb of

nuchal filaments. It is named for Mr. Edwin Chapin Starks, in recognition of his work on the fishes of the Pacific Coast.

29. Exerpes asper (Jenkins & Evermann).

Auchenopterus asper Jenkins & Evermann, Proc. U. S. Nat. Mus., 1888, 154. Guaymas.

The widely separated and ribbon-like first dorsal fin, formed of three close set spines, may distinguish *asper* generically from the other species of *Auchenopterus*. The genus *Exerpes* Jordan & Evermann, based on it, is further distinguished by the long, sharp snout, and the long ventrals. The species has been well figured by Jenkins & Evermann. (Proc. U. S. Nat. Mus., 1891; plate II.)

30. Chasmodes jenkinsi Jordan & Evermann, n. sp. Plate xxxix.

Hypsoblennius striatus Evermann & Jenkins, Proc. U. S. Nat. Mus., 1891, 163, Guaymas, not of Steindachner.

Head 3⅓ (4 in total); depth 4 (5). D. XII, 17; A. 18 or 19; eye 4 to 5 in head.

Body more robust than in related species, resembling *Hypsoblennius;* head large, gently rounded in profile, the snout steep, 4 in head; interorbital space narrow,

Color in life, according to Evermann & Jenkins, yellowish; five quadrate spots of darker extending from dorsal to a line drawn from middle of eye to lower base of caudal, the anterior one above tip of pectoral; median line of side with a more or less distinct series of small spots; a short dark vertical line behind the eye; a dark blotch in front of origin of dorsal fin and another on humeral region; under side of head with two ill-defined bands of dark; dorsal fin more or less speckled with black, the anal with a narrow white border above which is a broader band of deep brown.

Six specimens, the largest about 3 inches long, were obtained at Guaymas, Sonora, by Dr. Evermann and Dr. Jenkins in 1887. One of these, No. 412, L. S. Jr. University Mus., examined by us, is the type of the present description.

The large mouth distinguishes this species at once from *Hypsoblennius striatus*, with which it has been identified. The species is intermediate between typical *Chasmodes* and *Hypsoblennius*, and its discovery may make it necessary to merge the latter in *Chasmodes*.

31. **Runula azalea** Jordan & Bollman. Plate xxxvii.

Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 171. Indefatigable Island.

I present a plate taken from one of the types of this interesting little Blenny.

32. **Lucioblennius alepidotus** Gilbert. Plate xxxvii.

Gilbert, Proc. U. S. Nat. Mus., 1890, 103. Gulf of California.

The genus *Lucioblennius* is very close to *Chænopsis* of the West Indies, and belongs to the *Chænopsinæ*. It is not possible to separate this group, as a family, from the *Blenniidæ* until the various intermediate subfamilies, *Pholidichthyinæ*, *Pseudoblenniinæ*, *Emblemariinæ* and *Ophio-*

blenniinæ are better known. The accompanying plate is from one of the types.

Family LYCODAPODIDÆ.

33. Lycodapus fierasfer Gilbert. Plate xxxiii.

Lycodapus fierasfer Gilbert, Proc. U. S. Nat. Mus., 1890, 108. Station 2980, etc.

The genus *Lycodapus* cannot be retained among the *Zoarcidæ*, as its general relations are with *Fierasfer* rather than *Lycodes*. It seems to represent a distinct family *(Lycodapodidæ)* distinguished from *Fierasfer* by the normal position of the vent, which is not at the throat. Its gill membranes are separate and free from the isthmus. The accompanying plate is taken from one of the types.

Family BROTULIDÆ.

34. Bregmaceros macclellandi (Thompson).

Bregmaceros macclellandi Thompson, Charlesworth's Mag. Nat. Hist., 1840. India.

Bregmaceros bathymaster Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 178. Off Coast of Colombia, near Panama.

Two additional specimens of the species called *Bregmaceros bathymaster* have been found since the species

mer's recent paper on the Cranial Characters of *Sebastodes*, Proc. Cal. Acad. Sci., 1895, pp. 573 to 611.

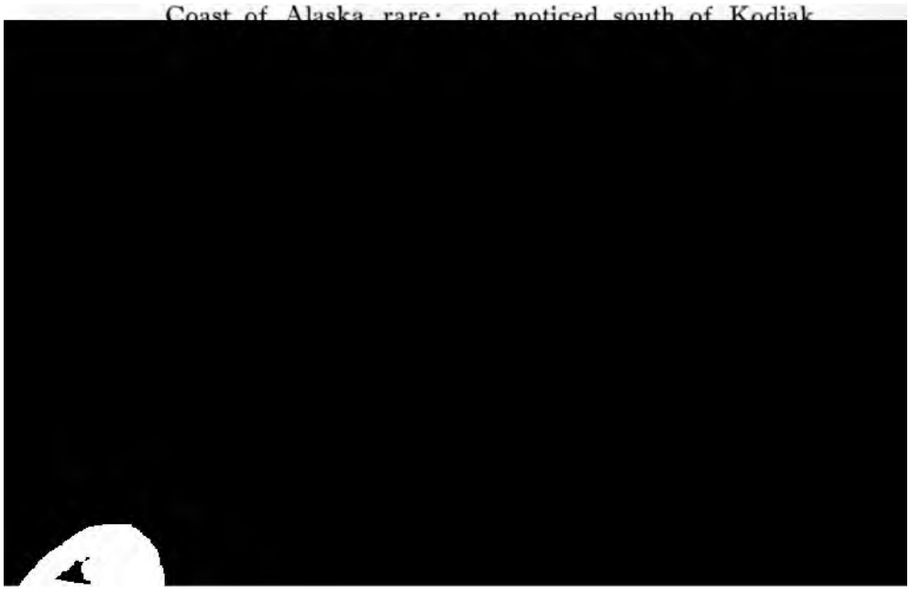
Family SCORPÆNIDÆ.

35. Sebastodes ciliatus (Tilesius). Plate xl.

Head 3¼, depth 3 to 3¼; D. XIII, 16; A. III, 8; P. 18 to 19. Transverse (oblique) rows of scales 46 to 47 (+3 or 4 on caudal). Pores 46 to 47. Body compressed, deep, its width over the base of the pectorals about 2 in the depth. Dorsal outline descending rapidly backward in a slight curve from origin of first dorsal to end of second dorsal. Depth of peduncle more than 3 in depth of body. Head compressed, profile steep and nearly straight. Eye moderate, orbit circular, 3⅔ in head, a little longer than snout, its posterior rim at about the middle of length of head. Interorbital space strongly convex, its width a little less than orbit, 3⅘ to 4 in head. Nasal spines small; cranial ridges and spines all obsolete, except the parietal; parietal ridges very slightly developed, with a minute point or none, covered with scales. Mouth moderate, quite oblique; tip of upper jaw on a level with center of eye; maxillary 2⅓ in head, its posterior end reaching about to vertical from posterior edge of pupil. Lower jaw a little projecting, with a slight symphyseal knob. Very narrow bands of teeth on jaws, vomer and palatines. Preorbital moderate, its lower edge scarcely at all indented or entirely continuous, spineless. Suborbital stay scarcely visible. Preopercular spines small, the three upper directed backward and slightly diverging, nearly equidistant and of equal size, the two lower minute or obsolescent. Opercular spines small, without visible ridges. Gill-rakers slender, 2 in orbit, 23 to 24 on anterior limb of first arch. Dorsal fin rather low, the spines delicate, the 5th longest, 2¼ to 2⅙ in head, the 2d about equal to

the 11th, the 12th about 1⅓ in the 13th; the membrane rather deeply incised anteriorly, and reaching about half way up the 13th spine. Soft rays about equal to the spines. Caudal fin slightly lunate, its length about 1½ in head. Second and third anal spines about equal in length, the former a little stronger, 1⅓ in the soft rays. Pectorals reaching very nearly to vent, a little less than head, 3½ in body, their base nearly 3 in their length, the median rays longest. Ventrals not reaching vent, about 1⅓ in pectorals. Scales on body, opercles and interorbital space strongly ctenoid; those on mandibles, maxillaries and most of those on cheeks cycloid; preorbital and snout with minute scales. Accessory scales few. Color, in alcohol, dark reddish brown, mottled with lighter; top of head nearly black, a dark stripe on edge of lower jaw, another on maxillary; a dark brown band from preorbital downward and backward to posterior edge of preopercle; a broader band from posterior rim of orbit downward and backward across preopercle and opercle. Fins all dusky, the dorsals somewhat mottled. Peritoneum black. The following description of the color is added from Jordan & Gilbert's Synopsis: "Blackish green, sides rather pale, much mixed with darker; dark shades from eye backward; a black streak on maxillary."

Coast of Alaska rare; not noticed south of Kodiak



taken. It is named for Mr. Timothy Hopkins, founder of the Hopkins Seaside Laboratory at Monterey. Since this description was written, numerous additional examples have been secured. It is evidently not rare about Monterey.

37. Sebastodes eigenmanni Cramer, n. sp. Plate xlii.

Head $2\frac{7}{10}$; depth $2\frac{5}{6}$. D. VIII, 14; A. III, 8; P. 18 ($\frac{9}{9}$); Lat. 1; pores 41 (+2 on base of caudal); transverse rows of scales 41.

Body compressed, its width (behind opercles) about $2\frac{1}{2}$ in its depth. Greatest width of head $2\frac{2}{3}$ in its length. Profile steep; interorbital space flat, $5\frac{1}{7}$ in head; supraocular and parietal ridges quite well developed, the former flat, the latter diverging backward. Preocular, supraocular, postocular, tympanic and parietal spines present, not very large, but sharp; a curved shallow groove at each side of the interorbital space inside of the supraocular ridges. Orbit large, nearly circular, $3\frac{1}{4}$ in head, its upper rim on a level with the profile. Snout short, about equal to interorbital width; preorbital moderate, with two small sharp spines directed downward and backward; maxillary $2\frac{2}{3}$ in head, reaching a little beyond vertical from posterior edge of pupil; mandible projecting somewhat, with a moderate symphyseal knob. The uppermost preopercular spine small, directed a little upward, the second longest, horizontal, the fourth and fifth small, but evident; upper opercular spine slender and sharp, the lower shorter. Gill-rakers long and slender, about $2\frac{1}{3}$ in the orbit, 23 on horizontal limb of first arch. Scales rough, ctenoid, those on opercles, cheeks and interorbital space and snout somewhat rough; those on maxillary, mandible and breast mostly cycloid; very few accessory scales. Spines of first dorsal moderate, the

fourth longest, 2¼ in head, the fifth, sixth and seventh nearly equal, the twelfth 2¼ in the fourth; the membrane deeply incised; longest dorsal ray about equal to longest spine. Anal spines graduated; the second nearly as long as and but little stronger than third, $2\frac{3}{5}$ in head, 1⅓ in the soft rays. Caudal truncate, or a little rounded (the rays somewhat injured). Base of pectorals 4 in head, the nine lower rays simple, the middle rays longest, reaching a little beyond vent, $3\frac{1}{5}$ in length of body.

Ventrals reaching vent.

Color in alcohol: Reddish-brown; pale below; dorsals and pectorals dusky; membranes of spinous dorsal black-edged, and tips of ventrals blackish. Peritoneum white, with a few black specks.

One specimen, 7 inches long, taken at Monterey, California, by Dr. Wilbur W. Thoburn; No. 4046, L. S. Jr. Univ. Mus.

It is named for Dr. Carl H. Eigenmann, of the University of Indiana, in recognition of his work on the genus *Sebastodes*. The species is nearest to *Sebastodes ovalis*, but the mouth is larger and the color different.

38. Sebastodes darwini Cramer, n. sp.

[1] *Sebastes oculata* Jenyns, Voyage H. M. S. Beagle, Zool. Fish. No. ii, part iv, 37, 1840, Valparaiso.

Closely allied to *Sebastodes rosaceus*. Spines similar in

third (subequal in *S. rosaceus*); dorsal spines lower, 3 in head (2⅔ in *rosaceus*). Scales similar. Mexillones, Peru.

Here described from MS. notes of Dr. D. S. Jordan, taken from the type in Mus. Comp. Zool., Cambridge, Mass.

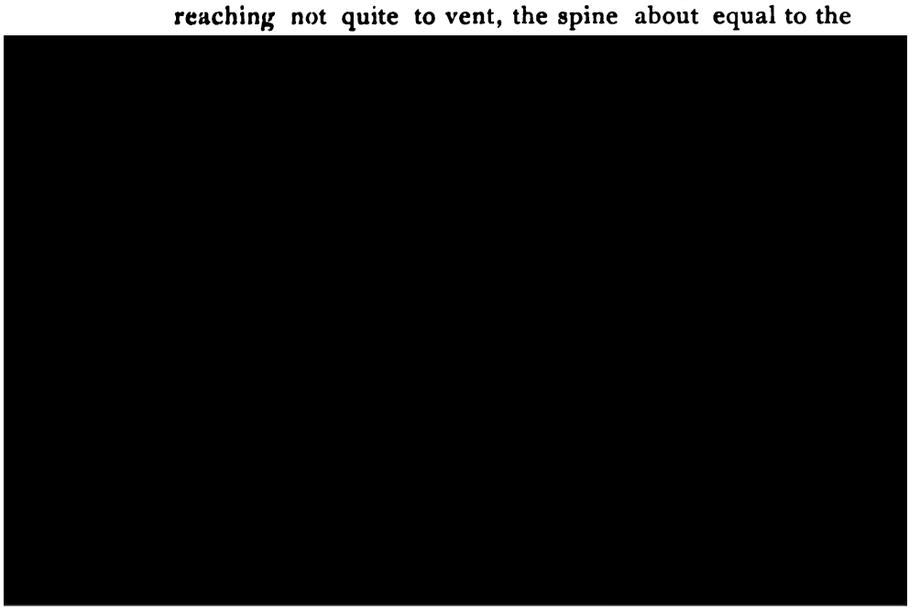
Jenyns described a specimen from Valparaiso as the *Sebastodes oculatus* of Cuvier and Valenciennes; but pointed out distinctions between the two, which with later knowledge of related species prove beyond a doubt that it is distinct. This specimen probably belongs to *Sebastodes darwini*. Jenyns also mentions a figure of another species from Valparaiso, very distinct from the others in having the spines of the head less developed. More than 50 species of the genus have been described from the north temperate waters of the Pacific Coast of America, and it is not improbable that the species of this genus will be found numerous in the temperate waters of the South American Coast.

39. Sebastodes gilberti Cramer, n. sp. Plate xliii.

Head $2\frac{1}{10}$; depth 2¾ to 3. D. XIII, 13. A. III, 6. P. 17; transverse (oblique) rows of scales 40 to 42; lat. l. (pores) about 39 to 42. Body somewhat compressed, its width over the base of the pectorals nearly two in the depth. Head compressed, profile steep, nearly straight. Preocular, postocular, tympanic and parietal spines and ridges present, all rather delicate, these spines somewhat appressed, the parietal ridges diverging backward in slight curves. Interorbital space 1½ in orbit, a little concave, with a pair of low ridges and a shallow median groove between them. Orbit high up, nearly circular, 4 in head, its posterior rim at about the middle of length of head. Preorbital scarcely lobate on its ventral margin, usually with one short triangular spine posteriorly. Sub-

orbital stay not visible externally. Preopercular spines all directed backward, the two uppermost closer together, the two lowermost weak. Opercular spines rather small, sharp, without visible ridges. Mouth nearly horizontal, the tip of the upper jaw nearly on a level with the lower rim of the orbit. Maxillary $2\frac{2}{3}$ in head, its posterior end reaching about to vertical from posterior rim of orbit. Lower jaw very slightly projecting, with a slight symphyseal knob. Teeth on jaws, vomer and palatines, the bands on the latter narrow. Gill-rakers rather slender, 2 to 3 in orbit, 23 on anterior limb of first arch.

Fourth dorsal spine highest, $1\frac{1}{1\frac{1}{2}}$ in head; membrane of first dorsal very deeply incised, reaching only ¼ of the way up on the anterior side of the 3d, and about ⅓ of the way up on the 4th spine, nearly to the tip of the 12th, and about half way up on the 13th spine; soft rays lower than the spines, about $1\frac{1}{3}$ in the longest spine. Caudal fin truncate, with 11 to 12 full length rays, about $1\frac{3}{4}$ in head. Second anal spine longer and much stronger than third, $2\frac{2}{3}$ in head, $1\frac{1}{2}$ in the soft rays. Pectoral fin reaching to or a little beyond vent, 3¼ in length of body, the median rays longest, the 8 lower rays unbranched and thickened; base of fin 3 in its length. Ventrals reaching not quite to vent, the spine about equal to the



rim of orbit across preopercle and lower end of subopercle; a dark blotch on opercle; a blackish area in front of dorsal and under first and second spines, extending with interruptions to axils of pectorals and on to the base of the fin, and downward and backward in a narrow broken band toward vent; another band from below 6th and 7th dorsal spines downward and backward nearly to origin of anal; a third short one from below 9th and 10th spines to lateral line; a broad one under soft dorsal extending below lateral line, and another across peduncle; all these dark areas extend up on the dorsal fin; their outlines are not sharply defined, and they as well as the lighter areas of the body are mottled with scattered, much darker spots; the lighter areas were in the fresh state a dull brick red, becoming lighter below. Dorsal membrane blackish between 1st and 3d, and between 5th and 11th spines. Soft dorsal spotted with blackish anteriorly; membrane of caudal dusky, the dark much broken into spots; anal and ventrals dusky. Pectorals with a broad, transverse, dark, spotted band near base, and a transverse dusky area with darker spots on distal half. Fins in life more or less tinged with the reddish color. Peritoneum white. Types, three specimens 7½, 8¼ and 8½ inches long (No. 3893, L. S. Jr. Univ.), from Monterey, found in San Francisco market. Many others have been since obtained from Monterey, where it is common. The species is an ally of *Sebastodes carnatus* and *Sebastodes chrysomelas*. It had been previously confounded with the young of *Sebastodes carnatus*. It seems to reach a smaller size than any of the related forms.

This species is named from Prof. Charles Henry Gilbert, of Leland Stanford Junior University.

LIST OF PLATES.

XX. Zaprora silenus: type. Nanaimo, British Columbia.
XXI. Nemichthys avocetta. Victoria, British Columbia.
Avocettina gillii. Albatross Station, off Oregon.
XXII. Salmo gairdneri crescentis: type. Lake Crescent, Washington.
XXIII. Salmo gairdneri beardsleei: type. Lake Crescent, Washington.
XXIV. Xenocys jessiæ: type. Charles Island, Galapagos.
XXV. Umbrina sinaloæ: type. Mazatlan, Mexico.
XXVI. Emmydrichthys vulcanus: type. Hawaiian Islands.
XXVII. Cottus annæ: type. Eagle River, Gypsum, Colorado.
XXVIII. Tarandichthys filamentosus: type. Off Santa Barbara Islands.
XXIX. Icelinus quadriseriatus. Coast of California.
XXX. Ulca marmorata. Unalaska.
XXXI. Kathetostoma averruncus: type. Off Panama.
XXXII. Gillellus semicinctus: type. Gulf of California.
Rimicola eigenmanni: type. Todos Santos Bay, Baja California.
XXXIII. Dactylagnus mundus. Gulf of California.
Lycodapus fierasfer: type. Albatross Station, 2980, N. W. Coast of Mexico.
XXXIV. Bryssetæres pinniger: type. Puerto Refugio, Gulf of California.
XXXV. Arbaciosa humeralis: type. Puerto Refugio, Gulf of California.
XXXVI. Arbaciosa rhessodon. San Diego, California.
XXXVII. Arbaciosa eos. Mazatlan, Mexico.
Runula azalea: type. Indefatigable Island.
Lucioblennius alepidotus: type. Gulf of California.
XXXVIII. Thalassophryne dowi. Panama.

NOTES ON FRESH WATER FISHES OF THE PACIFIC SLOPE OF NORTH AMERICA.*

BY CLOUDSLEY RUTTER.

The present paper contains studies of fishes from certain regions of the Pacific Slope, and is based on material in the museums of Leland Stanford Jr. University and the California Academy of Sciences. In its preparation I have been under many obligations to my teachers in ichthiology, Professor Charles H. Gilbert and President David S. Jordan. The paper is divided into four parts, each independent of the others.

I.

ON THE STICKLEBACKS OF CALIFORNIA, WITH SPECIAL REFERENCE TO THEIR INDIVIDUAL VARIATIONS.

The Sticklebacks of the Pacific Slope have been described under ten specific names. Of these ten nominal species, four—*Gasterosteus obolarius* Cuvier & Valenciennes, *Gasterosteus insculptus* Richardson, *Gasterosteus serratus* Ayers, and *Gasterosteus intermedius* Girard—have been shown by Jordan and Gilbert to be synonyms of *Gasterosteus cataphractus* (Pallas). Three—*Gasterosteus plebeius* Girard, *Gasterosteus inopinatus* Girard, and *Gasterosteus pugetti* Girard—are likewise known to be synonyms of *Gasterosteus microcephalus* Girard. The other species has been described under the one name only—*Gasterosteus williamsoni* Girard.

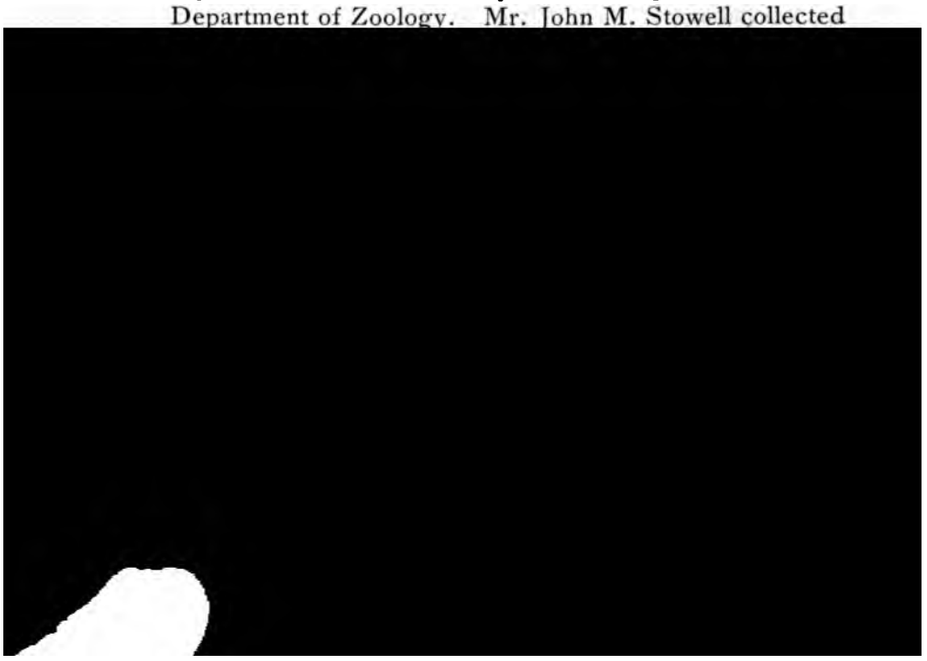
The chief character used in distinguishing these three recognized species is the completeness of the lateral armor. This armature consists of a series of vertical

*Contributions to Biology from the Hopkins Seaside Laboratory. No. 6.

PROC. CAL. ACAD. SCI., 2D SER., VOL. VI. (18) June 22, 1896.

imbricated plates, which cover the whole side of the body anteriorly, becoming smaller posteriorly and forming a keel on the tail. So far as is known, *Gasterosteus cataphractus* is invariably fully plated from head to caudal fin. This species does not enter the streams. The typical *microcephalus* has the sides partly plated, and *williamsoni* has been described as entirely without plates. Both of these forms are chiefly confined to fresh water. It is of the variations in these two nominal species—*Gasterosteus microcephalus* and *Gasterosteus williamsoni*—that the present paper treats.

It was first noticed that the number of lateral plates in specimens of *Gasterosteus microcephalus* from San Francisquito Creek, which empties into San Francisco Bay at Palo Alto, was considerably less than that of specimens from San Gregorio Creek, which flows directly into the ocean on the opposite side of the peninsula. This led me to the inspection of specimens from other localities. In all, over twenty-two hundred specimens, representing thirty-nine localities, have been examined by me. Specimens from localities in the vicinity of Stanford University have been collected by various expeditions of the Department of Zoology. Mr. John M. Stowell collected



When only a few plates are present, I have always found them to be those which join the post-pectoral plate below and the dorsal plates above. The post-pectoral plate, which is never wanting, is a wing of the pubic plate extending up the side behind the pectoral fin. The first plates to disappear are those in front of the caudal keel, the keel being next to go. Several specimens from brackish pools near Ballard, Washington, are an exception to this, the plates of the caudal keel being the only ones absent.

Below is given a table showing the variation in the number of lateral plates in specimens from different localities, the arrangement being in the order of the average number of plates. I here regard the whole series as forming one species, *Gasterosteus williamsoni*, with two varieties or subspecies, *williamsoni* and *microcephalus*, the latter being the prevalent form; the former, or typical form (because earliest known), originally described from near Saugus in Ventura county, Cal., being more local and confined to inland waters.

TABLE SHOWING THE VARIATION IN THE NUMBER OF PLATES IN *GASTEROSTEUS WILLIAMSONI*.

The number at the head of each column indicates the number of plates.

Locality.	No. specimens examined	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Fully	Average Number
Santa Ana R., Colton, Cal.	44	43	..	½	½	...	...	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0
Santa Ana R., Riverside, Cal.	111	104	4	3	..	...	...	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0
Rio Salado, Mexico	3	1	½	½	1	...	...	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Santa Clara R., Ventura Co., Cal.	298	76	41	99	67	15	...	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Rio Pajaro, Santa Cruz Co., Cal.	4	...	..	1	1	2	...	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3
San Miguel Cr., San Miguel, Cal.	107	1	1	4	..	101	...	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
La Laguna, Santa Maria R., Santa Barbara Co., Cal.	87	½	½	8	8	33	32	5	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Gassus Cr., San Mateo Co., Cal.	129	5	..	1	5	5	...	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Santa Ynez R., Santa Barbara Co., Cal.	129	...	..	..	2	35	61	28	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5
Salinas R., Soledad, Cal.	173	...	..	..	1	..	170	..	1	..	..	1	..	..	..	..	..	..	..	..	..	..	..	5
Adobe Cr., Santa Clara Co., Cal.	115	...	..	..	..	...	115	..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5
San Luis Cr., San																								

TABLE SHOWING THE VARIATION IN THE NUMBER OF PLATES IN *GASTEROSTEUS WILLIAMSONI*—CONTINUED.

The number at the head of each column indicates the number of plates.

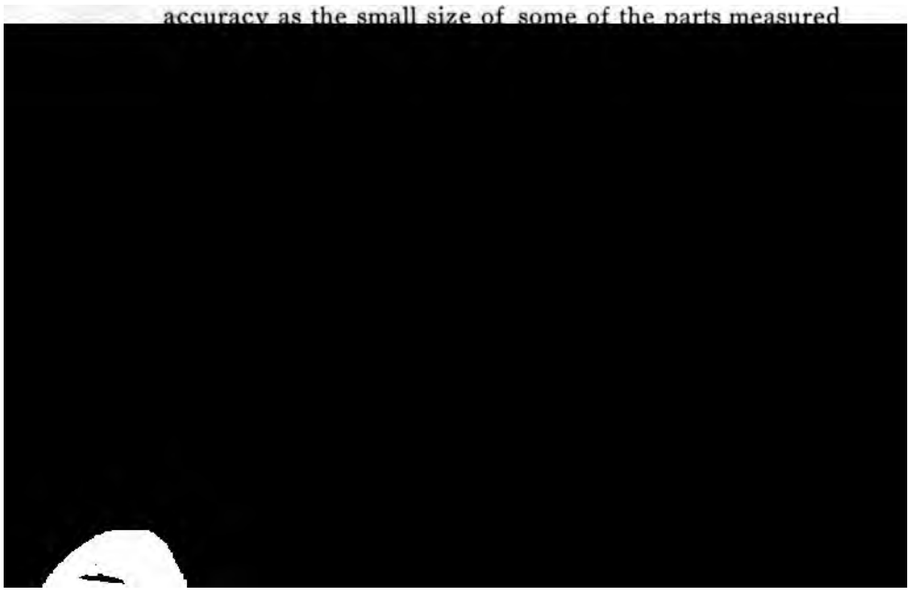
LOCALITY.	No. specimens examined.	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	Fully.	Average Number.
Soquel Cr., Santa Cruz Co., Cal.	34	...	..	..	..	1	1	..	4	2	7	6	3	2	5	..	1	..	1	..	..	..	1	10
Pajaro R., Watsonville, Cal.	43	...	..	..	..	3	18	13	...	..	..	..	..	2	..	1	1	1	..	1	..	..	3	10
Skookemchuck Cr., Chehalis, Wash	39	...	..	..	..	..	..	1	11	6	1	..	..	2	3	1	2	1	..	1	..	1	9	13
Aptos Creek, Santa Cruz Co., Cal	2	...	..	..	..	..	..	1	...	..	..	..	..	..	..	..	..	..	..	..	..	..	1	15
Walla Walla R., Wallula, Wash.	46	...	..	..	..	1	3	1	3	5	1	.	2	2	2	3	1	3	2	3	4	2	8	15
Brackish Pools, Ballard, Wash.	57	...	..	..	..	.	...	1	2	2	..	1	..	2	1	2	3	2	1	3	..	..	37	20
San Gregorio Cr., San Mateo Co., Cal.	47	...	..	..	..	..	..	..	...	1	3	..	3	..	3	2	..	1	2	2	1	1	28	20
Scott Creek, Santa Cruz Co., Cal.	11	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	Fully
Liddel Cr., Santa Cruz Co., Cal.	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	"
San Vicente Cr., Santa Cruz Co., Cal	41	...	..	..	..	..	..	..	...	..	..	..	..	1	..	..	..	..	..	..	..	..	40	"
Pescadero Cr., San Mateo Co., Cal.	4	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	"
Wadell Cr., Santa Cruz Co., Cal.	46	...	..	..	..	..	..	1	...	..	..	..	..	..	..	..	..	..	..	..	..	..	45	"
Pilarcitos Cr., Spanishtown, Cal	100	...	..	..	.	...	...	1	1	1	..	1	3	..	1	4	3	2	1	2	1	..	79	"
Klaskanine R., Astoria, Or.	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	"
North Umpqua R. Roseburg, Or.	14	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	"

This table shows a complete gradation in the number of plates from specimens wholly naked to those fully plated. The specimens from the Santa Ana River are almost invariably without any plates. About one-fourth of those from the Santa Clara River in Ventura county are without plates, the others having from one to four. Into this stream flow the brooks of Williamson's Pass, which is the type locality of *Gasterosteus williamsoni*.

The specimens here noted agree with the original description of that species, except in the presence of plates as above noted. The original description was based on eight specimens. Our specimens from the San Miguel Creek have an average of four plates, only one having none. Adobe Creek furnishes 115 specimens, with from four to six plates. None of the 175 specimens from San Francisquito Creek have fewer than four plates, and four specimens are fully plated. The specimens from Walla Walla River range from four plates to a fully plated body, the average number of plates being fifteen. Seventy-nine per cent. of the specimens from Pilarcitos Creek, emptying into Half Moon Bay, are fully plated, but some have as few as six or seven. From several localities the specimens are all fully plated, but it is worthy of note that in such cases we have only a few specimens. Larger collections would doubtless show variation.

Dr. G. A. Boulenger has recorded similar variations in the English Stickleback, *Gasterosteus aculeatus*. The variations described by him were all found in one locality, in practically one haul of the seine. They correspond to those of our specimens from the Walla Walla River (see table).

From a number measurements, made with as much accuracy as the small size of some of the parts measured



ing a perfectly intergrading series from the plateless weak spined *williamsoni* to the fully plated, strongly armed form of *microcephalus*.

Other differences are as follows:

The tail of *microcephalus*, especially the more fully plated form, is somewhat depressed and rather slender. In the Colton and Riverside specimens (true *williamsoni)*, the tail is heavy, and it is somewhat compressed, or rounded. However this character shows great individual variation, and the well plated form of *microcephalns* differs as much from the poorly plated form as the latter does from *williamsoni*.

In the well plated forms the tail is provided with a keel on each side. This keel consists of a fleshy basis covered by the lateral plates, which here become keel-shaped. In the poorly plated form and in *williamsoni* the keel is absent.

The sides of the thoracic area are decidedly convex in *williamsoni*, becoming almost straight in the fully plated form of *microcephalus*. The post pectoral plate is heavier and notched in the more completely plated specimens. The pubic plate is more sharply pointed and more firmly attached to the interclavicles when the lateral armor is more complete. The first dorsal plates, those in front of the first dorsal spine, are small or wanting in the naked specimens, becoming larger and more firmly attached as the lateral armature becomes more completely developed.

The specimens of *williamsoni* that I have seen are smaller than the average of *microcephalus*.

There are fully intergrading series in these variations also.

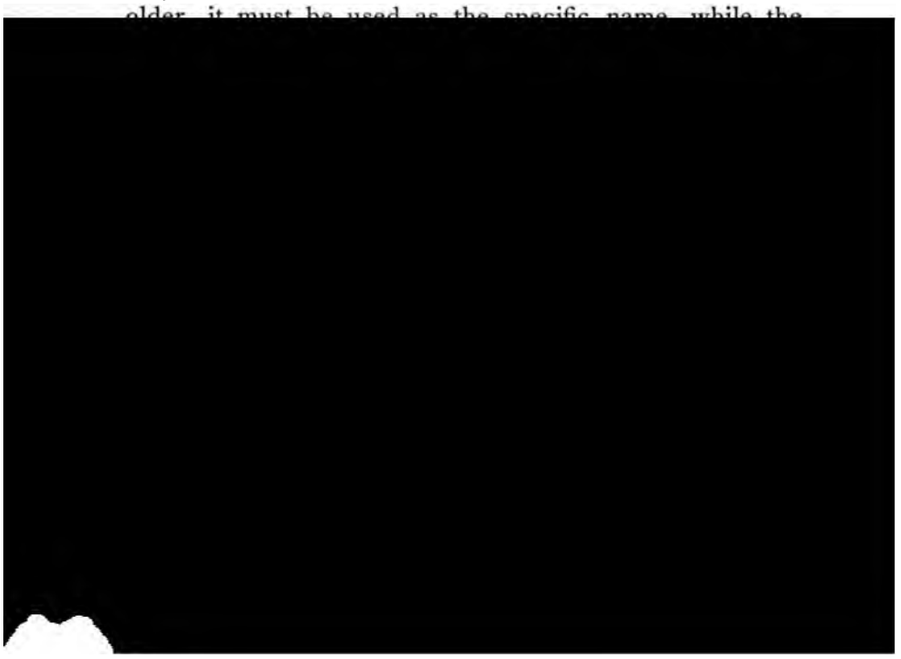
The following is a summary of the points in which variations exist and which may be used in distinguishing the two varieties. The average representative of the

parent form, called *microcephalus*, as compared with the average representative of the derived form, *williamsoni*, has:

1. The sides with more plates.
2. The pre-pectoral area larger.
3. The pubic plate longer and sharper.
4. The caudal peduncle or tail more slender.
5. The dorsal and ventral spines longer.
6. The pelvic girdle more firmly attached to the interclavicles.
7. The post-pectoral plate heavier.
8. The sides of the thoracic area less convex.
9. The first dorsal plates larger and more firmly attached.
10. A larger average size of the adult individual.

The fin rays are: *williamsoni*, dorsal 9 to 12, anal 7 or 8; *microcephalus*, dorsal 10 to 13, anal 7 to 9.

These numerous differences, together with the difference in distribution, necessitate the separation of *microcephalus* and *williamsoni*, but the fact that the differences all intergrade in intermediate territory, gives these forms only subspecific value. As the name *williamsoni* is the older it must be used as the specific name while the



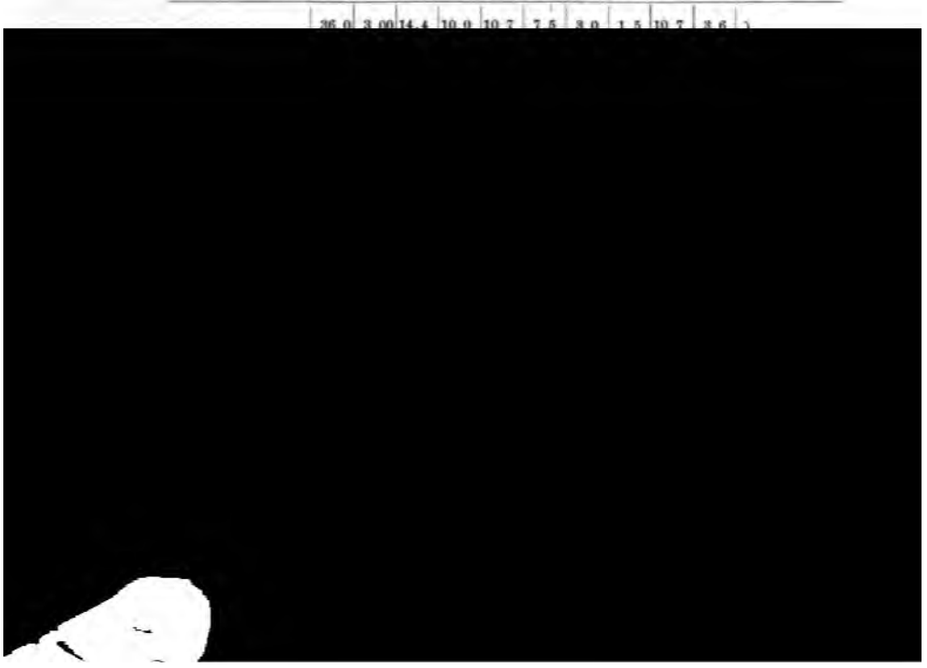
or stream condition. The most that can be said is that the more fully plated specimens have been taken in small coastwise streams, while the less fully plated ones usually, though not always, have been found farther inland. In general, there is no doubt that the forms having the armature more fully developed are nearer the primitive type. These live near the sea. These facts point to the descent of the species from *Gasterosteus cataphractus*.

The marine species, *Gasterosteus cataphractus*, itself shows little variation. It differs from the well plated form of *microcephalus* in having a more slender and compressed body, longer spines, longer pectorals, larger prepectoral area, more depressed caudal peduncle, and narrower pubic plate and thoracic area. These, again, are all differences of degree, and they point to the recent origin of *microcephalus* and *williamsoni*, brackish and fresh water forms, derived from those strictly marine. In like manner, doubtless, the partly naked fresh water forms of Eastern America and Europe have sprung from the marine species of the same region.

TABLE OF MEASUREMENTS.

(Specimens selected to show greatest variation.)

	Length of specimen in mm.	Head in length to base of C.	2d D. Sp. in length.	V. Sp. in length.	Pre-pectoral area in length.	Pubic plate in length.	Pubic plate, length + width.	Thoracic area, length + width.	Eye in length.	Depth in length.	Average number of plates from the locality.
Pilarcitos Creek.	45.0	3.00	11.0	7.4	9.4	6.0	2 4	2.0	11.0	3.7	Fully Plated.
	39.3	3.12	7.9	5.5	9.4	5.3	2.8	1.6	11.5	3.8	
	41.4	3.16	8.1	5.7	8.8	6.1	3.0	2.2	11.8	4.1	
	46.6	3.05	9.5	7.1	9.5	6.0	2.1	1.5	11.0	3.7	
	24.5	3.40	6.8	6.0	9.4	6.1	3.3	1 9	9 8	3.6	
San Francisquito Creek.	55.0	3.44	10.0	8.5	10.2	6.0	2.8	1.5	12.0	4 2	Six.
	52.8	3.24	10.6	7.7	8.9	5.8	2.4	1.5	12.0	4.1	
	53.9	3 31	11.7	7.8	8.7	5.7	2.5	1.7	12.5	4.1	
	56.2	3.45	10.0	7.6	9 9	5.8	2.7	1.5	12.2	4.0	
	55.3	3.35	10.4	7.8	9.1	5.8	2 7	1.6	12.0	4.0	
	54.0	3.21	10.6	7.7	8.7	5.7	2.8	1.3	11 5	3.7	
	61.5	3 59	9.6	7.4	9.8	5.3	2.5	1.6	13.4	3.4	
	37.0	3.22	10.6	7.4	9.5	6.9	3.2	2.2	11.6	4.1	
	35 7	3.29	7.3	5.7	9.4	5.9	3.8	2.0	11.5	4.0	
San Miguel Creek.	48.2	3.65	12.0	9.1	9.2	7.8	2.7	2.2	14.5	4.3	Four.
	35.3	3.22	11.4	7.5	8 8	6.8	2.5	2.2	11.0	3.9	
	51.0	3.40	12.7	10.2	9.3	6.9	2 0	1.8	13.4	3.9	
	54.0	3.40	12.0	9.6	10.0	6.4	2.7	1.7	12.3	3.9	
	36.9	3.30	9.2	7 5	9.5	7.0	2.8	1.9	12.3	4.1	
Riverside.	44.3	3.06	15.8	10.8	9.6	7.3	2.3	2.4	12.4	3.8	None.
	40.0	3.03	16.0	13.3	11.1	7.6	2.8	1.7	11.1	4.0	
	37.3	3.01	9.8	9.3	10.6	6.9	2.6	1.6	11.0	4.1	
	43.0	3.33	12.6	9.6	11.3	7.5	2.9	2.4	12.0	4.3	
	44.7	3.08	14.9	14.4	10.2	7.7	2.3	2.0	12.4	4.3	
	23.6	3.28	8.7	7.8	9.1	9.1	2.6	1.8	10.7	3.8	
	26.0	3.00	14.4	10.0	10.7	7.5	3.0	1.5	10.7	3.6	



II.

THE FISHES OF RIO YAQUI, SONORA, WITH THE DESCRIPTION OF A NEW GENUS OF SILURIDÆ.

This report is based on two small collections of fishes, one of two species made by Dr. Gustav Eisen at Hermosillo, and the other of six species by Mr. William Wightman Price, in the headwaters of Rio Yaqui, in northern Sonora and southern Arizona. The only collections heretofore reported from Sonora were made in San Bernardino Creek by the Mexican Boundary Survey. No species other than those here reported were obtained at that time.

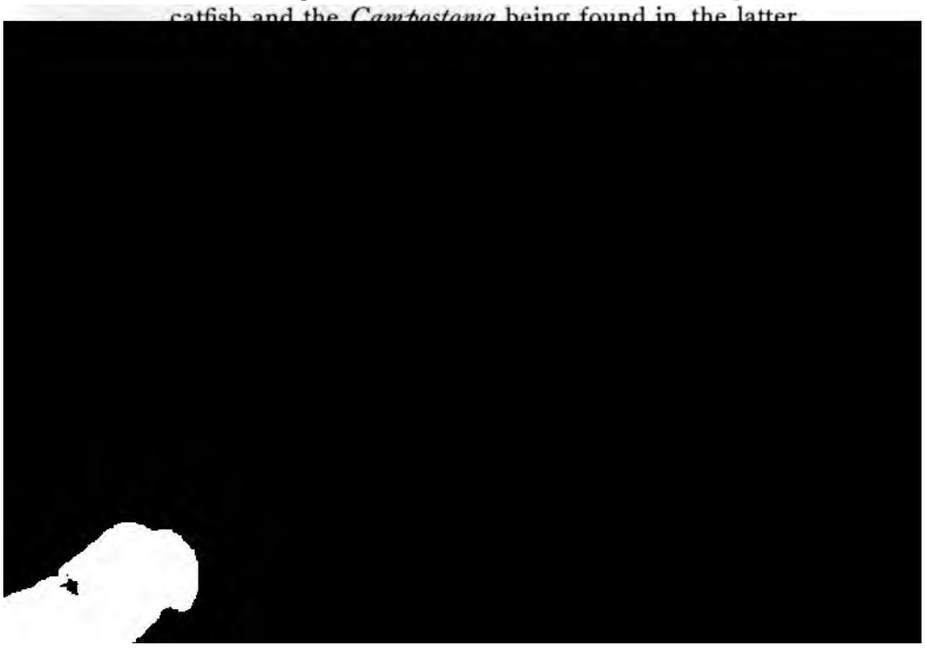
Dr. Eisen obtained his specimens from a tributary of the Rio Sonora, near Hermosillo, the capital of Sonora, while in charge of the exploring expedition sent out by the California Academy of Sciences in 1892. He gives the following notes on the stream in question:

The Sonora River at Hermosillo is a shallow stream, with so little water during the dry season that the stream becomes almost dry. Most of the water is taken out for irrigation above town, leaving the sandy bed dry below. In summer time after heavy rains, however, the water rises quickly and Rio Sonora may then become a torrent of several days' duration. East of Hermosillo the water increases rapidly, and even during the dry season may be several feet deep. The fishes collected were found in pools in the sandy bed, fed by a tiny streamlet in places simply percolating through the sand.

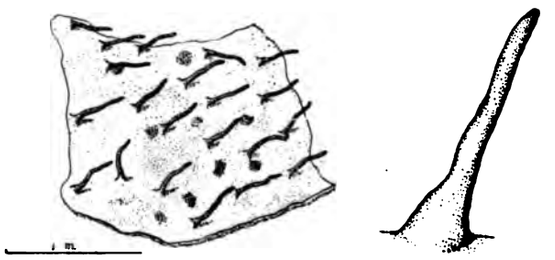
Mr. Price obtained specimens of fishes in 1894 while collecting birds and mammals in the mountains of southern Arizona and northern Sonora. His stations were (1) the Rio Yaqui, east of Oposura; (2) its tributary, San Bernardino Creek, at a point just south of the Arizona

line; (3) Morse Cañon, and (4) Rucker Cañon, small creeks in the Chiricahua Mountains, Arizona, which belong to the Yaqui Basin, although their waters disappear in the sand long before reaching any direct tributary of that stream. Mr. Price says that the region is much elevated, and, except in the mountains, nearly barren. The courses of the streams of Rucker and Morse cañons, and others similar in which he did not collect, can be traced for several miles into the desert, through which the water doubtless flows during freshets, but there is no evidence that it has reached the Yaqui in recent years.

Mr. Price's collection adds the family Siluridæ and the genus Campostoma to the list of types found in Pacific waters, this being the most northern record of a fresh water catfish on the Pacific slope, and the first record of *Campostoma* from the west slope. The species has been named *Campostoma pricei* by Jordan & Thoburn, but the species seems to be identical with *Campostoma ornatum* of the Rio Grande basin, an unexpected and curious fact, as the two basins are separated by the continental divide. The basin is more closely connected with that of the Gila, all of the species found in the former, excepting the new catfish and the *Campostoma* being found in the latter.



termaxillary band of teeth ⅓ of head. Caudal deeply forked, the upper lobe the longer. Barbels long, those of the maxillary extending past the gill opening. *Sides with scattered hair-like cirri.* These are very noticeable under a lens, but not readily distinguished by the naked eye,



This genus differs from all others of the family in having hair-like cirri on the sides. It differs from *Ictalurus* in having the occipital process and the interspinal buckler widely separated and connected by ligament; from *Ameiurus* in having a narrow head and a deeply forked caudal.

1. **Villarius pricei** Rutter, new species.

B. 8; D. I, 6; A. 22 to 23; C. 17; P. I, 9; V. 8.

Head 3⅓ to 3¾ in body; eye 5 to 7, snout 2⅔, maxillary 5½ to 6 in head. Maxillary barbel very long, reaching beyond the pectoral spine, in the adult specimen about to its tip when depressed, 3 to 4 times as long as the barbel at nostril. Origin of dorsal midway between snout and middle of base of adipose fin; pectorals inserted halfway between snout and ventrals. Longest dorsal ray six to seven times in length of body; spine of dorsal longer than its base, equal to base of adipose fin. Longest pectoral ray about half of head, pectoral spine 2½ to 3 in head, with about twelve distinct hooked serræ

behind. these fewer and somewhat smaller in a specimen 17 in. long. Base of anal three times in its distance from snout. its longest rays equal to those of the ventral. Caudal deeply forked. Lateral line present. but rather faint.

This species is closely related to the species described by Bean as *Amoiurus dugesii* (Proc. U. S. Nat. Mus., 1879. 304). differing in having very prominent serrations on the pectoral spines. the types of *dugesii* having the pectoral spines without serræ. I have examined a specimen of *dugesii*. 4 in. long. from Salamanca. Mex.. which is in the type basin. It has the cirri minute and light in color. a row of papillæ along the lateral line. and the pectoral spines with four or five degenerate serræ. The process from the occipital is as described above. and Mr. Bean informs me that the types have the sides with hair-like cirri. It. therefore. belongs in the same genus with *fricei* and may stand as *Villarius dugesii*.

This description is based on seven specimens (No. 4826, L. S. Jr. Univ.). 7 to 17½ in. long. from San Bernardino Creek. near the northern border of Sonora. Mexico.

The species is named for the collector. Mr. William Wightman Price.

Family CYPRINIDÆ.

3. **Campostoma ornatum** Girard. (*Campostoma pricei* Jordan & Thoburn.)

Five specimens, 1½ to 4 in. long, from Rucker Cañon, Chiricahua Mountains, Ariz.

Head 3½ to 4 in length; eye 3⅔ to 4½ in head, 5⅓ in an adult male; 31 to 35 scales before dorsal [31, 34, 35, 35]. Origin of dorsal midway between nostrils and rudimentary caudal rays. Maxillary extending to below anterior nostril; top of head 1½ in distance from occiput to dorsal (1¼ in one specimen).

These specimens are from the exact type locality of the specimen upon which Jordan and Thoburn based their description of *Campostoma pricei* (Fishes of North America, Jordan and Evermann, p. 205), and their type specimen is included in the notes here given. The receipt of more material and its comparison with specimens from Rio Conchas, Chihuahua, Mex., shows the species *pricei* not to be valid. The measurements for the Rio Conchas specimens are: Head 3½ to 3⅘; eye 4½ to 5; scales before dorsal 32 to 39; [32, 33, 36, 37, 37, 38, 39]; origin of dorsal and maxillary as given above; top of head 1½ in distance from occiput to dorsal, 1⅘ in one specimen.

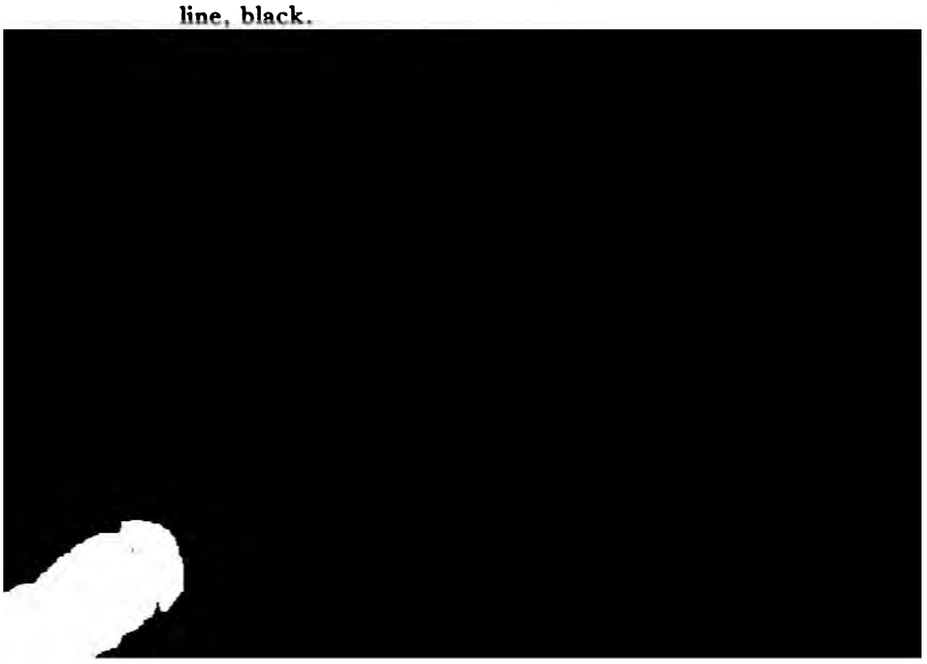
The convolutions of the alimentary canal in these specimens are quite different from those of *Campostoma anomalum*. Instead of having the alimentary canal wound around the air-bladder a number of times, it is folded back and forth antero-posteriorly below and at the side and makes only one fold on top, not going entirely around it at all. The intestines were found to have the same arrangement in a specimen of *Campostoma ornatum* from Rio Conchas, Mexico. In one of our specimens, a female, the alimentary canal was entirely below the air-bladder. In a specimen of *Campostoma anomalum* from Ross Lake,

near Cincinnati, Ohio, the alimentary canal was wound around the air-bladder more than a dozen times, though the ovaries were not thus inclosed.

4. **Leuciscus purpureus** Girard.

One specimen 1¼ inches long from Morse Cañon, and three of the same length from the Yaqui River, east of Oposura, are identified provisionally but very doubtfully with this species. The one from Morse Cañon has the head 3½, depth 3⅔ in length, eye 3½ in head, longer than snout. Dorsal 9, anal 7, lat. l. 53. Teeth 1, 4–5, 1. The three from the Yaqui have the following description:

Head 3¾ in length, eye 3½ in head, a little longer than snout. Dorsal 9, anal 7, lat. l. 70, complete. Teeth 4–4, hooked, with flat or slightly grooved grinding surface. Maxillary about to vertical from anterior margin of eye, slipping under the preorbital, without barbel. Mouth oblique, head pointed, lower jaw included. Dorsal inserted over ventrals; anal deep, pointed. Olive above, silvery below, sides and back finely dusted with black. Lateral band, caudal spot, and a median dorsal line, black.



grooved grinding surface. Scales very small, about 17–70 to 80–14, lateral line incomplete posteriorly. Alimentary canal 1¼ times length of body; peritoneum black. Dorsal inserted behind ventrals, the latter reaching the vent. Anal deep, extending when depressed half way from its hinder margin to caudal.

Color of Hermosillo specimens, in alcohol, a dark median dorsal stripe, a dark lateral band, above which the sides are brown; under parts silvery; sides in and above the lateral band finely dusted with black; a distinct black spot at base of caudal; fins all pale. The specimens collected by Mr. Price have lost their color markings.

6. Pœcilia occidentalis (Baird & Girard).

Numerous specimens from the Yaqui, east of Oposura, collected by Mr. Price, and from Hermosillo, collected by Dr. Eisen. The following description is based on the latter, those collected by Mr. Price not differing materially. This species, as Mr. Garman has shown, is a true *Pœcilia*, not a *Heterandria:*

Dorsal 7 or 8; anal 7; ventral 6. Scales 28–7. Head 3⅔ to 4 in length, depth 3½ to 4. Eye 3⅓ in head, equal to or slightly longer than snout, a little less than two times in interorbital width. Teeth in a double crescentric row in each jaw, with a series of minute teeth behind them, not readily appreciable. Origin of dorsal in middle of total length in females, more anterior in males; behind the anal in males, where it is nearer pectorals than caudal, above posterior rays of anal in females. Anal process 1⅗ to 2 times head, in some specimens extending to caudal, bent to one side at its extremity with minute serrulations. Adult males have the ventral fins very small and placed almost below the pectorals; the females have them larger and inserted below the tips of the pectorals.

Several specimens, which are doubtless immature males, resemble the females, except in having the anterior rays of the anal somewhat elongate, but not yet developed into a true anal process. Anal basis short, four times in lower side of caudal peduncle.

Color, in alcohol, a dark lateral band usually present on posterior half of body, with a distinct black line through its middle. A black line present on lower side of caudal peduncle. Scales edged with dark. Females otherwise very light, the fins unmarked. Adult males very dark, all fins with dark shadings; young males resembling the females in color.

Of the thirty-three specimens collected by Dr. Eisen, three are adult males and five or six others seem to be immature males. The largest male is 1 inch, the largest female 1¼ inches. The largest collected by Mr. Price are, male 1¼ inches, and female 2¼ inches.

Mr. Price also fished Sabino Cañon, a tributary of the Santa Cruz, of the Gila Basin, obtaining *Leuciscus intermedius* and *Pœcilia occidentalis;* and from the Rio San Pedro at Fairbank, Arizona, also in the Gila Basin, he obtained *Pantosteus clarki* and *Agosia chrysogaster*. I have the following note on

Leuciscus intermedius (Girard):

III.

NOTE ON A COLLECTION OF FISHES MADE IN STREAMS NEAR CAPE SAN LUCAS BY DR. GUSTAV EISEN.

A small collection of fishes, consisting of nine species, was obtained by Dr. Gustav Eisen in fresh water streams about Cape San Lucas, in Baja California. The species are all well known, but their occurrence in this region is worthy of record.

1. **Siphostoma starksi** Jordan & Culver.

Numerous specimens of this species from San José del Cabo. They differ somewhat from the types of *Siphostoma starksi* in having a longer body and shorter tail, though there is considerable variation in both lots of specimens.

Head 10½ to 10⅔; dorsal 37 to 39; pectoral 13. Head 3¾ to 4 in distance from snout to vent; head and body 1¾ to 1⅘ in tail; snout 2½ to 2⅖ in head. Two lateral keels on body, the upper ceasing and the lower curving upward under posterior part of dorsal, as in the types. Dorsal beginning over, or in some specimens, one segment behind vent. Color quite dark, a rather regular series of light-colored dots along sides; middle rays of caudal black, outer with irregular blotches.

2. **Agonostomus nasutus** (Günther).

One specimen, 4¼ inches long, from San José del Cabo. It agrees in all essential characters with the original description, which was based on a specimen 8½ inches long from the Rio San Geronimo in Guatemala. The eye, however, is 3½ in head, 4⅕ in an 8-inch specimen from Mazatlan, instead of 5; the caudal is emarginate, the middle rays ⅗ length of outer. The soft dorsal is not so high as the spinous dorsal and is as high as the anal, in-

stead of being higher than the spinous dorsal and lower than the anal.

Head $3\frac{4}{5}$, depth $3\frac{2}{5}$ in length: dorsal IV–I, 8; anal II, 10. Of specimens from Mazatlan, some have the anal II, 10, and some III, 9. The lateral line is faintly indicated; scales 6–44–6, 19 before dorsal, extending forward to anterior margin of pupil. Preorbital serrate on lower edge, the serræ not evident on larger specimens from Mazatlan. Pectoral $1\frac{2}{3}$ in head, not quite equal to distance from nostril to margin of opercle. All fins, except the spinous dorsal, have scales on the basal part, and it has an elongate accessory scale on each side. The fourth spine of the dorsal is weak.

3. **Mugil albula** Linnæus. LA LIZA.

Two specimens, 9 in. long, from fresh water at San José del Cabo. Head 4 in length. Scales 38 and 39. Dorsal and anal scaled on anterior rays only.

4. **Mugil curema** Cuvier & Valenciennes. TRUCHA: LIZA.

Numerous specimens, 1½ to 8 in. long, from La Paz, and from Rio San José, San José del Cabo. This and

7. **Dormitator maculatus** (Bloch.) PARGETA, LA PAJEQUE.

Nine specimens, 2¼ to 4¼ in. long, from Rio San José, San José del Cabo.

Head 3⅓, depth 3½ in length. Dorsal VII–I, 8; anal I, 9. According to Dr. Eisen, the spot in front of the pectoral is blue in life.

8. **Eleotris pictus** (Kner & Steindachner). (*Eleotris æquidens* Jordan & Gilbert.)

Eight specimens, 3 to 14 in. long, from fresh water at San José del Cabo. They agree with the original description by Jordan & Gilbert, except in minor details.

Head 3 to 3⅓ in length; maxillary 2½ to 2¾ in head; scales 61 to 68, 25 or 26 in an oblique series downward and backward from the origin of the dorsal. Eye 2 to 2¾ in interorbital width, the latter in a specimen 14 in. long. No conspicuous knobs at upper anterior and posterior margins of orbit; if such were conspicuous in the types, they were probably due to shrivelling. Preopercular spine covered by the skin.

Dr. Gilbert informs me that *Eleotris æquideus*, of which species he has specimens from Panama, is identical with the form earlier known as *Eleotris pictus*.

9. **Awaous taiasica** (Lichtenstein). LA PUJEQUE, MUCHURA.

Six specimens, 2¼ to 3½ in. long, from Rio San José, San José del Cabo.

Dorsal VI–I, 10, the first ray of the second dorsal being unsegmented; eye 4½ to 5 in head. The anterior profile of the head is much curved, as is the case with smaller specimens from Mazatlan.

10. Spheroides annulatus (Jenyns).

Five specimens, 3 to 3½ in. long, from La Paz. The bar at base of pectoral is indistinct, and there is a pale edging at tip of caudal.

IV.

DESCRIPTION OF A NEW SPECIES OF CHARACONDON FROM TEPIC, MEXICO.

Characodon eiseni Rutter, new species.

Head 3½; depth 3¼; eye 3. Dorsal 11 to 13; anal 13; scales 30 to 32, 12. Snout shorter than eye, lower jaw projecting. About nine teeth in upper jaw and about 14 in lower. Teeth strongly bicuspid, the villiform teeth not developed. Mouth almost vertical when closed, mandible about half length of eye. Interorbital space flat, the anterior part equal to orbit, wider posteriorly. Insertion of dorsal in middle of total length; anal inserted under 4th ray of dorsal. Pectoral reaching past insertion of ventral. Tips of depressed dorsal and anal in vertical through middle of caudal peduncle. Caudal broad, truncate, length of middle rays equal to length of top of caudal peduncle. Head about ¼ of total; great-

L. S. Jr. Univ. Mus.), the largest 1¼ inches long, from a branch of the Rio Grande de Santiago at Tepic, Mexico.

The species is named for Dr. Gustav Eisen, who collected it with the following species in 1894:

Pœcilia occidentalis (Baird & Girard).

Numerous specimens of this species were taken with the above. They do not differ from specimens from Hermosillo.

DESCRIPTION OF A NEW SPECIES OF PIPE-FISH (SIPHOSTOMA SINALOÆ) FROM MAZATLAN.

BY DAVID STARR JORDAN AND EDWIN CHAPIN STARKS.

Siphostoma sinaloæ Jordan & Starks, n. sp.

Allied to *Siphostoma arctum* Jenkins & Evermann.

Head 8½ in length to base of caudal; depth 3½ in head; dorsal 26, on 1½+5 rings 14+35.

Snout 1¼ in head, a strong median ridge above running to between middle of eyes, a ridge on each side from angle of mouth to below eye, occipital and nuchal plates keeled, a slight keel on anterior part of opercle; dorsal keels ceasing in front of the last four or five rays of dorsal, the lateral ridge running up and continuing as dorsal ridges; belly with a keel on each side. Preanal part of belly 1¾ in postanal part; pectoral shorter than eye; caudal 3 in head.

Color olive brown above, abruptly lighter below lateral ridges anteriorly, the edges of the plates dark, forming reticulations on lower parts of body, between every four rings is a narrow white cross-bar; from each eye is a narrow light bar running upward and backward to occi-

NOTE ON DELTISTES, A NEW GENUS OF CATOSTOMOID FISHES.

BY ALVIN SEALE.

In studying the skulls of the different species of *Chasmistes*, a genus of Suckers characteristic of the land-locked lakes of the Great Basins of Utah, Nevada, and Oregon, I observed a notable difference in the form of the gill-rakers of *Chasmistes luxatus* Cope, as compared with the other species. In this species the gill-rakers are broad, shaped like the Greek letter △ (delta), and their edges are unarmed and entire. In the other species referred to *Chasmistes*, the gill-rakers are, as in *Catostomus*, narrower and marked with a fringe of fine teeth on the inner dorsal margin. This character seems to be of generic value, and the name *Deltistes* is here proposed for the group typified by *Deltistes luxatus*. In both *Chasmistes* and *Deltistes* the lower pharyngeals are weak, with numerous small teeth.

I may further note that *Catostomus fecundus* Cope, is a species of *Chasmistes*, and that the genus *Lipomyzon* Cope, cannot be separated from *Chasmistes*.

The known species of *Chasmistes* may be thus distinguished:

a. Scales moderate, 60 to 65 in lateral line.
  b. Mouth small; nose with a prominent hump, formed by the extension of a small "pre-nasal" bone between the bases of the premaxillary spines; scales 8–64–9; dorsal rays 11. Utah Lake. *fecundus* Cope.
  bb. Mouth large; hump on snout rather less prominent; lips thinner and smooth.
    c. Scales 10–62–9; dorsal rays 11. Utah Lake. *liorus* Jordan.
    cc. Scales 13–65–11; dorsal rays 12; head very wide. Pyramid Lake. *cujus* Cope.
aa. Scales small, 72 in lateral line; snout short, without prominent hump; cranial surface smooth; scales 12–72–11; dorsal 11; mouth rather small. Klamath Lake. *brevirostris* Cope.

REPORT ON A COLLECTION OF PLANTS FROM SAN JUAN COUNTY, IN SOUTHEASTERN UTAH.

BY ALICE EASTWOOD.

[With Plates xliv-xlvi.]

FIELD REPORT.

The plants described in the following report were collected in the valley and on the plateaus of the San Juan River, from near the McElmo Creek junction to where Willow Creek joins the San Juan. A few were collected along the lower part of McElmo Creek, which really forms part of the valley of the San Juan.

From Mancos in southwestern Colorado to Willow Creek in southeastern Utah is about one hundred and fifty miles, making a total journey of probably three hundred miles. Owing to a limited vacation, eight days was all the time that could be spared for the exploration, the collection is necessarily incomplete. Besides the mules that we rode, we had one pack animal to carry all supplies and my constantly increasing botanical acquisitions. Under the circumstances I had to curb my zeal for col-

ill's invitation to take this trip, full of hardships, through an uninhabited and unexplored desert country.

We left Mancos July 10, 1895, riding the first day to the lower end of McElmo Cañon. The alkaline clay through which this creek runs is being rapidly washed away. Whenever the creek is flooded by rains near its source, the banks are undermined, great tracts fall in with a noise like thunder, and the stream runs liquid mud into the San Juan below.*

The Cliff-dweller's ruins that are found along the rocky walls of the cañon have made this creek famous. The tower on the McElmo has been frequently pictured and is even modeled in exhibits of American archæology.

Settlers have taken up ranches along this creek, where their possession of the land is constantly threatened by the ravenous stream that has lured them to make homes in this unfavorable region. The climate is milder in winter than in the Montezuma Valley at the head of the McElmo,—apples, peaches and other fruits being successfully raised; but it is a most undesirable place for a home, where the water is alkaline, where the sun beats down in summer with an intense glare and heat, and where the children of the settlers grow up knowing more of the arts and luxuries of the neighboring Utes and Navajos than of civilized man.

Earlier in the season the flora of this cañon is exceedingly interesting; but at this time, little remained, besides the shrubs that are common in alkaline soils. *Fraxinus*

*It is only since the settlement of the country that McElmo Creek has become such a greedy stream. The dams at the heads of the irrigating ditches, of which there are many, cause the water to work out through the soil and soften the foundations of the surface above. Before the cañon was settled the creek could hardly be called a good arroyo above where an occasional flood would come down a branch stream from Ute Mountain.—ALFRED WETHERILL.

anomala, *Quercus Gambellii* and *Celtis occidentalis* grew where the soil was less alkaline, where the wash from the sandstone cañon walls mixed some sand with the clay; but for miles near the lower end of the cañon, *Sarcobatus vermiculatus*, *Grayia polygaloides*, *Artemisia tridentata*, *Suæda Torreyana*, and various species of Atriplex almost exclusively covered acres with a gray-green vegetation. A few cottonwoods and willows were seen occasionally, most abundant in the neighborhood of Hill's Ranch, near the Colorado-Utah boundary and off the main road.

Towards evening of the second day we reached the San Juan River. The bluffs on the other side of the river, visible for many miles, had inspired us with fresh vigor, in the hope of good water and rest under the shade of the trees. There was very little vegetation on the dry mesas above the McElmo: occasionally a ravine would store enough moisture to keep a few plants alive, such as *Wyethia scabra* and *Amsonia angustifolia Texana*. We were near camp when *Mentzelia pumila* began to open out its starry blossoms: *Heliotropium convolvulaceum* was rare: and *Cladothrix lanuginosa* spread its small mat down here and there: *Eriogonum flexum* and *cernuum*, *Gilia Gunnisoni*, *pumila* and *leptomeria* were abundant occa-

degei was plentiful in front of the belt of trees, spreading out in circular bunches sometimes nearly a yard across, not yet in bloom but conspicuous because of the white-veined leaves. The weeds of civilization have not yet reached this place—not even *Capsella Bursa-pastoris* or *Polygonum aviculare*, usually the first vegetable emigrants to a newly settled country.

The next morning, July 12, we started down the San Juan River. On the opposite side could be seen the fields and flocks of the Navajos, the river forming part of the Reservation boundary. Sometimes we rode under the trees, but generally through the heavy sand, without any protection from the burning sun. Chenopodiaceous plants were very abundant, almost monopolizing the soil of the argillaceous and sandy alkaline flats. Montezuma Creek was passed—not a drop of water, where in the spring a torrent of muddy water flows; next came Recapture Creek, the limit of Mr. Brandegee's exploration. It was in the dry bed of this creek that *Dicoria paniculata* occurred and an unusually tall *Petalostemon candidus*. *Datura meteloides* opened out its magnificent flowers at the base of the rocks from which the alkaline flats extended to the river, and *Erigeron Bellidiastrum* hugged the same shelter. *Atriplices* grew dense and tall, but were only beginning to bloom and in no condition for collection or determination. *Cycloloma platyphyllum* looked ghastly, being yellowish-white instead of the deep purple with which I have always been familiar.

As we approached Bluff City, the Mormon town that is the extreme outpost of civilization, the bluffs which rise on each side of the river—sometimes distant, sometimes near—arose to a more lofty height. About midway on these cliffs the character of the rocks changes and the change is marked from a distance by a line of green.

The water from the mesa above sinks in the underlying strata, and there on a narrow bench, not more than a yard wide, constantly oozes out. Here is a most strange vegetation, a boreal oasis in the midst of a sonoran desert. It was in this place that *Aquilegia micrantha* was first discovered by Mr. Alfred Wetherill, who now took me to the type locality, and here grew *Primula Parryi*, *Saxifraga Californica*, *Mimulus rubellus*, *Epilobium hirsutum grandiflorum*, *Sarcobatus vermiculatus* and *Epipactis gigantea*. How did these waifs reach that solitary bench, with nothing in the surrounding country in the slightest degree allied? Below, along the San Juan River was the riparian vegetation common to rivers of the Upper Sonoran: above, on the mesas, the Mentzelia, Gilia, Abronia and Eriogonum were probably growing; not another species of Aquilegia or Primula nearer than the La Plata Mountains, distant more than a hundred miles. Here, these plants have been growing and blooming for ages probably, indicating the character of the vegetation before the river wore down the cliffs to the present level, an instructive remnant of a past flora. *Primula Parryi*, *Saxifraga Californica*, *Mimulus rubellus* and *Epilobium hirsutum grandiflorum* showed some deviation from typical forms,

Bluff City, at an altitude of about 5,000 feet, is a little Mormon settlement, with a post-office and two stores and not even one saloon. The effects of both stores could be loaded into one wagon. The people live well, raising fruits and vegetables, depending for meat upon the sheep of the Navajos and the cattle of the white men. It was this town that was the center of a gold mining excitement about three years ago, when wonderful stories were told of the treasures of the Rio San Juan.

On the road leaving the town we met the last human beings, some half-starved Navajos, just coming in. The sandy soil was covered with *Heliotropium* full of its beautiful white blossoms, filling the air with fragrance.

It was dusk when we reached Butler Spring, where another problem in the geographical distribution of plants presented itself. This spring is at the bottom of a sandstone mesa or wash, and at the head of a cañon down which a stream pours into the San Juan when the rainy season is on. It is a constant spring of pure water, forming a pool below the marshy bank from which the water issues. Here were found *Rhamnus Purshiana*, *Ampelopsis quinquefolia* and *Adiantum capillus-veneris*. The *Rhamnus* has large alder-like leaves, similar to the form along the more northern States of the Pacific Coast. The *Adiantum* was not found elsewhere, but the *Ampelopsis* was collected also in the gorge of the San Juan River. These plants did not show characters noticeably different from those of the same species found elsewhere and were probably brought there by birds. The berries of the *Ampelopsis* and *Rhamnus* being attractive to birds, would be easily carried in their digestive organs and the indigestible stones left behind where the birds came for water. The spores of the *Adiantum* could readily be carried in the mud adhering to the plumage

and feet of the birds, and finding a cool, moist, shady situation, would soon grow and flourish. Above the springs stretched a far-reaching mesa through which the rocky wash of Butler Creek extended. On the bare sandstone above, black, polished, flattened, rounded boulders had worked depressions for themselves in the sandstone from which no flood could dislodge them. These stones were entirely different from any rocks in the immediate neighborhood or any seen elsewhere on the trip. They looked more like relics of a glacier than anything else.

That night we rode through Butler Cañon in the dusk, and camped after dark on the banks of the San Juan, just above where the gorge begins. A dense thicket of *Cleome integrifolia*, more than six feet high, had to be pulled up so as to form a camping place. The odor of the *Cleome* and *Datura meteloides*, which also grew rank in the same spot, made the atmosphere almost unendurable. On the return we camped at Butler Spring, and some interesting plants were found in the cañon below and on the wash above. *Quercus Gambellii* and *Q. undulata* both grew in the cañon, the latter easily distinguishable by its blue-green foliage. *Rosa Fendleri* was abundant. These shrubs were apparently confined to

of lofty bluffs and the head of numerous cañons that finally branched into the San Juan. The views were grand on all sides. Far away on the other side of the San Juan were huge sculptured masses of rock looking like a fortified city of the Feudal Ages, with battlements and towers; near at hand, the cañons descended abruptly from the very head to a depth of hundreds of feet, constantly growing deeper towards the grand gorge of the San Juan, which stretched unbroken on the south side as if forming a bulwark against further erosion. These cañons formed a labyrinth, the division of land between appearing like the skeleton of a former mesa.

Evidences of upheaval were to be traced in the configuration of the strata on hills to the east. Examples of oblique, undulating and horizontal strata were all to be seen on this range of hills. It was impossible for me to discover the nature of the rocks, but the different colored strata indicated a variety of formations.

The flora of Epsom Creek and its adjacent sandy washes was peculiar and puzzling. *Oxytenia acerosa*, like a tall luxuriant golden rod with canescent filiform dissected leaves, grew most luxuriantly near the bitter waters of the alkaline springs of Epsom Creek. It was also seen along the McElmo and the San Juan near alkaline water. The delightful odor like that of lilacs was perceptible in the air for some distance around the plants and added greatly to the attractiveness of this beautiful alkali-loving plant. A few bushes of *Forestiera Neo-Mexicana* also grew around these springs. It was, however, in the sandy washes beyond, that the peculiar *Psoralea juncea* and *Grindelia stylosa* were met with, in company with *Ephedra Torreyana*, *Poliomintha incana*, and the tall, widely spreading *Frasera Utahensis*. All these are perennials, except the *Frasera*, a biennial, and formed

clumps around which the sand drifts; so that the surface of the sandy wash is almost as humpy as the hog-wallow lands of the San Joaquin Valley in California.

The bluff, at the foot of which we rode for many miles before reaching Willow Creek, consists really of a series of bluffs, each receding behind its predecessor and forming a serrated chain extending for miles. We generally rode over the talus from these cliffs, and it consisted not only of the small rocks usually to be expected but also of enormous boulders. The rains are very fierce sometimes in these regions. On the Grand River, near Moab, I have seen large waterfalls form in a few moments from the flood of water on the mesas above and dash over the cliffs, tearing away the rocks and soil with tremendous force. The serrated form of these cliffs is probably due to the greater washing away where the configuration of the mesa above forms channels along which the drainage collects, to be poured down the cliffs in cataracts here and there instead of one continuous sheet of water. An occasional tree of *Juniperus occidentalis monosperma* was sometimes seen. *Fraxinus anomala* grew as a shrub or small tree near the edge of cañons once in a while, but no other trees were to be seen. An intricately branched shrubby variety of *Polygala acanthoclada* was quite common, and *Eriogonum Jonesii* was

oasis, and here a greater variety of plants was found than in any other locality. *Aquilegia micrantha* was seen under the shadow of moist rocks, *Wyethia scabra*, *Cnicus Rothrockii* and *Frasera Utahensis*, flourished on the grassy slopes, while near the water grew *Salix longifolia* and *cordata*, which give the creek its name. At the large spring where Willow Creek heads, a grove of shrubs and trees forms a mass of green that can be seen for miles, consisting of willow, cottonwood, oak and Rhamnus.

The next morning, July 14, we rode down the steep slopes of the cañon to the junction with the San Juan River, where the two gorges meet. The most unexpected plant found in this cañon was *Aster spinosus*, a single clump only, which grew to a height of about six feet, and probably was more than a yard in diameter. The willows and ash were occasionally seen, but no oaks or conifers. In the deep gorge of the San Juan the vegetation was sparse along the river bank, the *Ampelopsis*, before alluded to, being the most interesting plant.

Wednesday morning we started on the return trip, passing over the same trail and arriving at Mancos Saturday morning, having collected about 475 specimens, representing 162 species and varieties, of which 19 are new and almost all are rare. It was a hard trip, about 300 miles altogether, through a desert country where springs are few and far between and good feed for the animals very scarce. The altitude is about 6,000 or 7,000 feet, and the whole region is to be considered as an outlying portion of the great Colorado plateau.

The collection is in the herbarium of the California Academy of Sciences, including all the types. Duplicates, when of sufficient number, have been distributed to the Gray Herbarium, National Herbarium, Herbarium of the Missouri Botanical Garden, Herbarium of the

Canadian Geological Survey, to William M. Canby, of Wilmington, Del., and to T. S. Brandegee, of San Diego, Cal.

BOTANICAL REPORT.

1. **Clematis ligusticifolia** (Nutt. ! mss.) Torr. & Gray, Fl. I, 9.

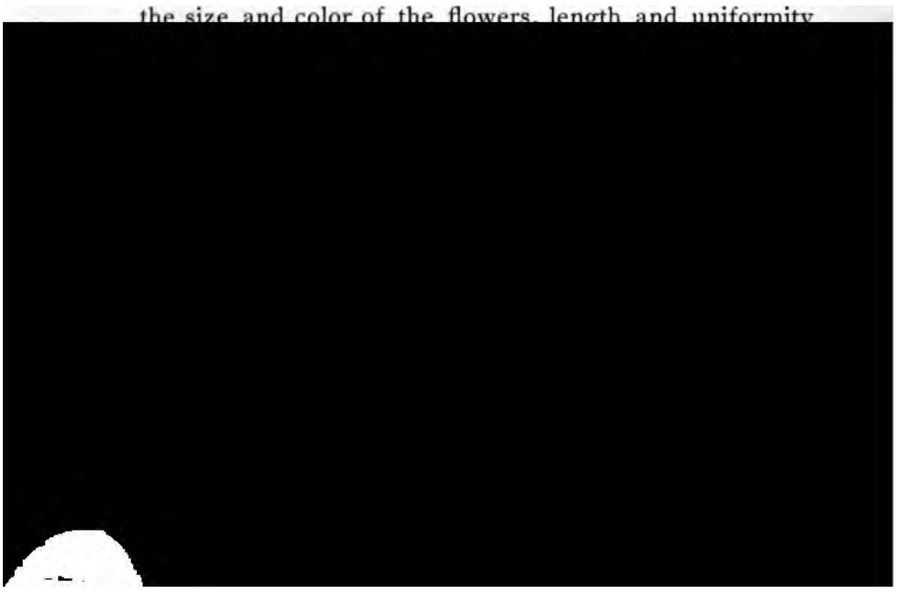
Range of type: "Plains of the Rocky Mountains, in open and in bushy places near streams."

Near the head of Willow Creek, along the pools of the interrupted creek. The specimen is a female plant, with akenes partly grown; the leaflets of the upper branches are almost entire, lanceolate-acuminate, varying in width near the base from 1 cm. to 4 mm. It shows the effect of its desert environment in its sparse, little dissected foliage and narrow leaflets; young parts silky-canescent, older parts nearly glabrous.

2. **Aquilegia micrantha** Eastwood, Proc. Cal. Acad. Sci., 2d Ser., iv, 559, t. 19.

Type locality: "Moist bench under the cliffs near Bluff City."

The specimens were collected at the type locality and also near the head of Willow Creek, with the same peculiar environment. There is considerable variation in the size and color of the flowers, length and uniformity



on the same plant, often more than 2 cm. in length; the stamens are generally more exserted than in the figure; the bracts are either trifoliate with entire oblanceolate divisions, or with lobed divisions, or sometimes even simple. Under favorable conditions, the plants have stems growing to a height of from 4–7 dm., leafy up to the inflorescence; flowering branches bare, except for the scattered bracts, which range from the decompound ones below through palmately cleft, to small and simple near the top; the lower leaves have long petioles, 9 or 10 cm., about half as long as the entire leaf, ultimate lobes 10 mm. wide.

Type specimen in the Herbarium of the California Academy of Sciences.

3. **Berberis Fremontii** Torr., Mex. Bound. Sur., 30.

This species was first discovered by Fremont, in 1844, on the tributaries of the Rio Virgen, in southern Utah. The description was drawn from specimens collected in western Texas and New Mexico, also cañon of the Guadaloupe River, Sonora. It is described as having blue berries. In King's Report, p. 416, Watson describes the fruit of specimens collected by Dr. Palmer at St. Thomas, southern Utah, as dry and bladdery, not blue.

The specimen collected near the head of Willow Creek is in fruit, the bladdery pods are rose color near the pedicel, yellowish above, dehiscing into two spreading valves. Specimens collected on the Grand River, near Moab, Utah, in 1892, have similar fruit.

The species was first put under *B. trifoliata* Moric., but the character of the fruit and the difference in the leaves distinguishes it easily.

4. **Argemone intermedia** Sweet, Hort. Brit., ed. 2, 585 (1830).

This was first described by James as *A. alba*, and was

collected on Long's Exped. ii, 149 (1823); but as the name *A. alba* is preoccupied, it takes the next, according to D. Prain, Journ. of Bot., xxxiii, 363.

This was collected only in fruit in two localities, shallow washes, tributary to Epsom Creek, on Barton's Range. It is near *Argemone corymbosa* Greene, in habit, but that species is only a variety of *A. intermedia*. Erythea, iv, 96.

My specimens are glabrous, moderately spiny on the stems and leaves; pods cylindrical, 2½ cm. long, 5–10 mm. wide, distinctly the pods of *A. intermedia*, without hispidity, but with long curved spines.

5. Tholypodium.

Collected in flower near the head of Willow Creek, noted also in Butler Wash, without fruit. This is near *T. integrifolium* Endl. and *T. Wrightii* Gray, probably a form connecting these two species, or perhaps new.

The flowers are in a close raceme, pedicels not elongating, 1 mm. long; the sepals have crimped, membranous margins. It is biennial, nearly six feet in height, with stout stems branching about half way up into few slender branches. The radical leaves had disappeared, lower

of the leaves on the same plant pinnatifid, others entire. This was seen also on rocky hills along Barton's Range, but more like the form common throughout the region.

7. **Lepidium alyssoides** Gray., Pl. Fendl., 10.

Type locality: "Mountain valleys, from Santa Fé eastward to Rabbit's Ear Creek."

Fruiting specimens collected near the head of Willow Creek. Leaves are mostly entire, linear-spatulate, a few near the base are from 2–7 lobed; flowers inconspicuous.

8. **Lesquerella Fendleri** Wats., Proc. Am. Acad., xxiii, 250.

Vesicaria Fendleri Gray., Pl. Fendl., 9.

Type locality: "On the smaller hills around Santa Fé."

This was abundant on bare hills and along washes throughout Barton's Range; collected in both flower and fruit.

9. **Cleome integrifolia** Torr. & Gray., Fl. i, 122.

Type locality: "Plains of the Platte to Oregon."

Common along the flats of the San Juan River, forming thickets 5 or 6 ft. high.

10. **Polygala acanthoclada** Gray, var. **intricata** n. var.

Shrub 9 dm. high, sometimes lower, branching near the top with erect-spreading branches at the ends of which are downward-spreading thorny branchlets that are again branched, so that the thorny branchlets are intrically mixed; lower leaves 2 cm. long, linear-spatulate, slightly pubescent; flower and 3-bracted pedicels glabrous; boss on the keel cordate, green; wings white, tipped with rose-color; sepals white; pods oval, emarginate, red on the margin, slightly inflated, 4 mm. long, 3 mm. wide. The stems are as densely canescent as in the type, but

the canescence does not extend to the leaves and flowers. The species was originally collected on the side of a bluff near the San Juan River in Utah, not far from the Colorado boundary (Proc. Am. Acad., xi, 73). The variety comes from the same region and specimens were collected at the head of the cañons branching into the San Juan and in Willow Creek Cañon.

Type in the Herbarium of the California Academy of Sciences.

11. **Arenaria Fendleri** Gray, Pl. Fendl., 13.

Type locality: "Prairies, five miles west of Las Vegas."

Collected near Butler Spring and the head of Willow Creek. No flowers; seed pods dry and empty.

12. **Talinum brachypodium** Watson, Proc. Am. Acad., xx, 355.

Type locality: "Near the Indian Village, Laguna or 'Komach,' in northwestern New Mexico;" discovered by Mr. and Mrs. J. G. Lemmon, July, 1884.

Abundant on the stony mesa above Butler Spring, growing with long fleshy roots amid the flattened stones. In bloom probably near midday; seen late in the evening

Specimens collected at Butler Spring approach var. *dissectum*. The plant is greener than the common form, with stellate pubescence more scattered, almost wanting on the lower part of the stem; racemes loosely flowered; leaves 3-divided, with entire or 2–3 lobed divisions. It is much less luxuriant than the form common on the plains around Denver, and shows the effect of its drier environment.

15. **Sida hederacea** (Hook), Fl. Bor. Amer., 1, 107, under *Malva* Dougl. ms.; Torr. in Gray, Pl. Fendl., 23.

Type locality: "In the interior districts of Columbia."

Seen only on the sandy flats of the San Juan River, near Bluff City. This seems to be the most eastern station reported for this species.

16. **Linum aristatum** Engelm., Wislizenus Rep., 17.

Type locality: "In sandy soil near Carizal, south of El Paso."

Var. **subteres,** n. var., Trelease in ed. Near the head of Willow Creek, in the sand that had collected in the rocky basin of the wash. Dr. Trelease regards this as a new variety, perhaps a new species.

17. ***Rhamnus Purshiana** DC., Hook. Fl. Bor. Amer., 1, 123, t. 43. *R. alnifolia* L'Her., in Pursh. Fl. 1, 166.

Type locality: "On the banks of the River Kooskooskky."

This species seemed like a waif from the north. Only one bush was seen growing in the wet bank from which the spring issued. Leaves obovate or elliptical, largest, with blade 9 cm. long, 4½ cm. wide; one berry four-

*This may be *Rhamnus betulæfolia* Greene, Pitt., iii, part 13, p. 16. It is from the same general region and seems to fit either description.

seeded, the rest three-seeded. It was startling to find this plant with *Ampelopsis quinquefolia* and *Adiantum capillus-veneris* in the midst of sonoran vegetation, where a living spring made an oasis in the desert. It also grows around Willow Creek Spring.

18. **Ampelopsis quinquefolia** Michx., Fl. 1, 160.

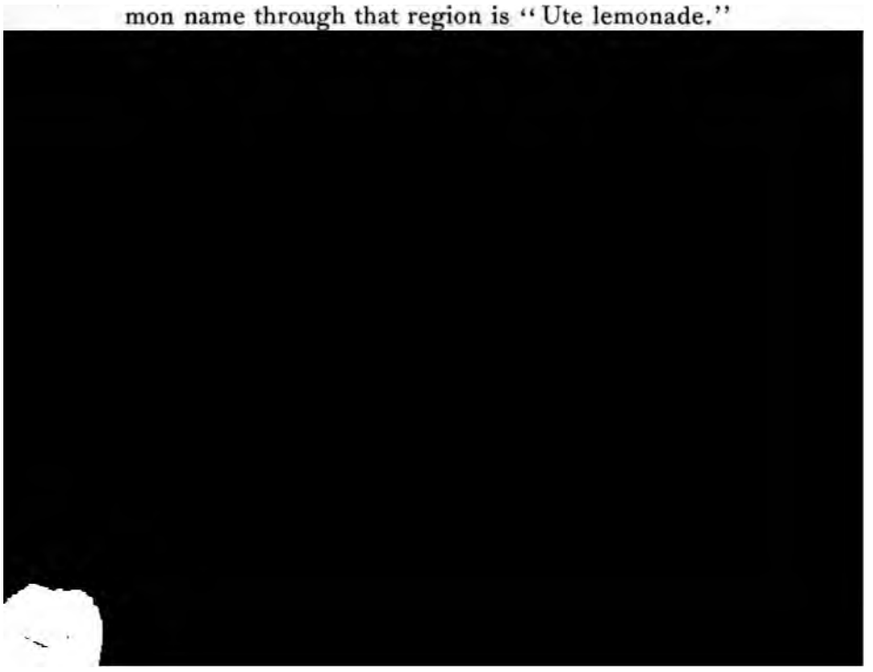
Type localities: "Virginia, Canada."

Collected in flower at Butler Spring and with immature fruit in the cañon of the San Juan River, near Willow Creek junction. Its presence along the banks of the San Juan is more easily understood, but at the head of Butler Wash, where all communication with riparian vegetation seems cut off, it is very puzzling.

19. **Rhus Canadensis** Marsh., var. **simplicifolia** Greene, Torr. Bull., xvii, 13.

Type locality: "In the deep cañons of northern Arizona, which lead down to the grand cañon of the Colorado."

This grew with the typical form on the sandy flats of the San Juan River, near Bluff City. The Utes use the red berries to make an acid drink, and the common name through that region is "Ute lemonade."



covered with yellow glands, which are variable in size; leaves subulate, 3–4 mm. long, ciliate and with numerous glands; leafless stems terminated by slender interrupted racemes of small flowers, solitary or in pairs; bracts minute, ovate-acuminate, deciduous; calyx canescent with silky hairs, attenuate to a short, densely hairy pedicel; upper lip obcordate, lower, cleft into three blunt teeth, hairy within; corolla dark blue, with broad banner emarginate and revolute; wings narrow, barely surpassing the banner, keel short and obtuse; pod 4 mm. in diameter, chartaceous, canescent with silky hairs which almost conceal the minute glands; seed loosely covered, 4 mm. long, light brown, flattened.

This singular and interesting Psoralea was found in one of the broad sandy washes of Epsom Creek. The sand formed knolls around the clumps which were scattered here and there over the desert waste. (*Poliomintha incana* and *Ephedra Torreyana* grew in the same locality and formed similar clumps.) With its numerous leafless virgate stems it suggested an Ephedra or a Juncus. It is related most nearly to *P. Purshii* Vail, from the character of the fruit and has undoubtedly degenerated from some leafy species because of its desert environment. It evidently secures a store of water in the sand by forming knolls and probably has a large root. (This was impossible to determine because of the loss of my pick.) There is an African species, a shrub, which has the lower leaves pinnate, but the upper reduced to scales.

I planted a seed which germinated but died when two pairs of leaves had formed. This seedling is shown natural size in the figure where the plant is delineated.

Type in the Herbarium of the California Academy of Sciences.

22. **Petalostemon candidus** Michx., Fl. ii. 49. t. 37.

Type localities: "In Tennessee and in the region of Illinois."

This grew in erect bunches about 12 dm. high, with well developed spikes 10–12 cm. in length on long peduncles. It was seen only on the sands of Recapture Creek under the trees, and, on account of its erect habit and greater size, was noticeably different from the form common on the plains around Denver or along the Platte River.

23. **Astragalus subcinereus** Gray, Proc. Am. Acad., xiii, 366.

Type locality: "Mokiak Pass in the northwestern part of Arizona near the Utah boundary."

On mesas above the San Juan River, in fruit, the inflated red-mottled pods numerous.

24. **Astragalus sabulonum** Gray, Proc. Am. Acad., xiii, 368.

Type locality: "Southeastern border of Nevada near the confluence of Muddy River with the Rio Virgen."

Abundant under the trees on the sandy flats of the San Juan River, not far from the junction with McElmo

This shrub is not common on the mesas above the San Juan River and not found at all in the lowlands. It was collected near the head of Willow Creek, with both flowers and fruit on the same plant.

27. **Rosa Fendleri** Crepin, Bull. Soc. Bot. Belg., xv, 91 (1876).

Type locality: "New Mexico," Fendler's No. 210, Coll. 1847.

This is evidently closely allied to *R. Californica.* The plants collected are slightly glandular and villous on the sepals, petioles and stipules; the stems and pedicels are smooth and glaucous; fruit globose without a neck. This was collected in fruit in Butler Wash nor far from the spring. It was abundant and luxuriant there, but not seen elsewhere.

28. **Œnothera brevipes** Gray, ex. Torr., Pac. R. R. Rep., iv, 87.

Type locality: "Gravelly hills on and near the Colorado."

This was found in similar situations in several places throughout Barton's Range.

29. **Œnothera biennis** var. **grandiflora** Lindl., Bot. Reg., t. 1604.

Type locality: "North America."

A specimen collected on the moist bench of the cliffs near Bluff City has the tube of the calyx remarkably long, one measuring 9 cm.; the buds with free calyx tips are 5 cm. long, 8 mm. wide, flowers not open. The plant was tall, hoary and not densely leaved.

The same species collected at Butler Spring has shorter buds and calyx tube and a shorter, more leafy stem. It was seen also at the head of Willow Creek. The variations are undoubtedly due to environment or isolation.

30. **Gaura coccinea** Nutt., Gen. i. 249.

Type locality: "Declivities of bare, gravelly hills from the Maha village to the Mandans."

This species common on the plains around Denver was collected along the sandy flats of the San Juan River under the cottonwood trees. It is about 5 dm. in height, branched from the base with stems simple up to the inflorescence; flowering stems elongating much beyond any specimens heretofore seen, 15–18 cm. long; the whole plant is almost glabrous.

31. **Mentzelia pterosperma** n. sp.

Annual, low, 10 to 20 cm. high, branching divaricately; stem white, shreddy, covered with fine and coarse, barbed hairs; lower leaves petioled, spatulate, often orbicular, sinuate-dentate or rarely entire, 15 or 20 mm. long without petiole, which is sometimes 10 mm. long; upper leaves sessile, broad at base, 3 cm. long, 2 cm. wide, but not uniform in shape or size; flowers on bracted peduncles at the ends of the branches; divisions of calyx triangular-acuminate, half as long as the petals, almost glabrous on the inner surface; petals lanceolate, 15 mm. long, 4 mm. wide, obtuse; outer stamens petaloid, anthers mi-

32. **Mentzelia pumila** Torr. & Gray, Fl. N. Am., i, 535.

Type locality: "Bare hills on the banks of Ham's Fork of the Colorado of the West, Oregon."

This was common throughout the region. Flowers opened about 5 P. M. Specimens collected near McElmo Creek and the San Juan River have cream-white flowers 3 cm. in diameter, leaves pinnately-lobed with obtuse divisions. A plant collected near the head of Willow Creek has pagoda-shaped leaves and pale yellow flowers 15–20 mm. in diameter, with sepals surpassing the petals; seeds similar to those of the other specimens.

NOTE.—*Cactaceæ* were not common nor were more than four kinds observed. Some species of *Opuntia* and *Echinocactus* were seen, but owing to poor condition, being without either flowers or fruit, and because of poor facilities for preserving, they were not collected.

33. **Houstonia saxicola** n. sp.

Stems several from a tap-root, woody, growing in clumps about 4 cm. high; whole plant minutely scabrous; leaves dense, linear-lanceolate, with revolute margins, apiculate, 10–12 mm. long, 1 mm. wide; younger leaves broader and shorter; stipules truncate or acute, membranous, uniting the petioles; flowers axillary, lobes of the calyx acuminate, about 1 mm. long; corolla salver form, lilac, tube slender, 10 mm. long, divisions veiny, 4 mm. long, 2 mm. wide; stamens inserted in the throat; style nearly 3 mm. beyond the throat; stigma with two diverging globose lobes; pod didymous, spreading open almost to the base, the two cells of each part prominent, nodding on curved peduncles; seeds dark brown, patelliform, minutely scrobiculate.

This was collected growing amid the stones on the

mesa above Butler Spring. It was in fruit; only one flowering specimen was seen.

It seems to be the same as *Houstonia rubra* Cav. of the Synoptical Flora, page 25. It does not agree, however, with the plant described and figured by Cavanilles Ic., v, 48, t. 474, fig. 1.

Type locality: "Near the Mexican town, Ixmiquikpan."

According to Cavanilles, *H. rubra* has a globose stigma not exserted beyond the throat of the corolla, sessile pods, subglobose seeds and red flowers.

I have examined Pringle's 274, hills and plains near Chihuahua; Rusby's 269, Mt. Defiance (near Bluewater), Lemmon's 2725, Igo's Ranch, near Huachuca Mountains, Arizona, and specimens collected by Benson, in Arizona. All show the two-lobed stigma, which is conspicuously exserted, except in Lemmon's specimen, where the stamens are exserted and the stigma included. These are all labeled *H. rubra*, but I am compelled to believe them not that species, as they all agree in the main with my specimens, and have the same environment, viz.: "Stony or gravelly hills."

24. Galium acutissimum Gray, Proc. Am. Acad. vii

tinct species. Besides the difference in pubescence the habit of growth is dissimilar. Specimens collected by E. L. Greene in the type locality have stems that appear to be climbing and diffusely branched. Another specimen from the same island (probably a part of the type), collected by Dr. Veatch and identified by Dr. Kellogg, shows the same habit.

My specimens have many rigid, simple stems, about 15 cm. high, springing from the base. They are in fruit. Dr. Newberry's specimens were in flower. Collected near the head of Willow Creek, July 13. Not abundant and seen nowhere else. Growing in the sandy soil covering the rocks of the Willow Creek Wash.

35. Gutierrezia Californica Torr. & Gray, Fl. of N.Am., ii, 193.

Type locality: "California," Douglas.

This seems far out of range for this species, but it agrees quite well with the original description and is reported in Syn. Fl., p. 115, from mesas of Arizona, collected by Palmer, Lemmon and Pringle. The scales of the pappus are acute, obtuse and often erose, not uniform on the same akene; those of the ray akenes less than half as long as those of the disk. On mesas above the San Juan River, beginning to bloom, July 13.

36. Grindelia stylosa n. sp.

Perennial, 6–9 dm. high, bushy, with many slender stems branching diffusely from a woody base; epidermis smooth, white, shreddy below, above becoming greener and more glutinous; leaves rigid, entire, 3-nerved, linear-lanceolate, acuminate and aristate, 3 cm. long, 3 mm. wide, diminishing upwards to the bracts of the involucre, vertical by a twist at the base which forms a cup-shaped cavity to hold the bud; heads corymbose, 15 mm. long,

10 wide, expanding with age; involucre turbinate, very glutinous, bracts squarrose in five ranks, acuminate, generally keeled with a dark purple midvein; ray flowers none; disk flowers with corolla slightly contracted at the throat, tapering at the base, 5-toothed, more than twice as long as the pappus; anthers surpassing the corolla, with prominent free tips; styles cylindrical, hairy, exserted beyond the stamens and apparently growing after the anthers become empty; pappus scales 3 mm. long, ⅓ mm. broad, corneus, linear-acuminate with fimbriate edges, stellately spreading in age; akenes 4-angled, 8-ribbed, truncate, somewhat hairy above, less so below.

This *Grindelia* is an extremely localized species. It differs from typical *Grindeliæ* in having entire leaves, turbinate involucre and more numerous persistent pappus bristles. The long, conspicuous styles give to the flower its chief beauty, hence the name. It grew in the same sandy waste as the equally local *Psoralea juncea*, and was just coming into bloom July 13th. There were many plants, but all specimens were from the only plant seen in bloom.

Type in the Herbarium of the California Academy of Sciences.

of the branchlets; entire plant hispid and scabrous; leaves few, oblanceolate, diminishing upwards, lowest 3–4 cm. long, 5 mm. wide; involucral bracts hispid and scabrous, ciliate on the rose-colored margins and tips. Collected near the head of Willow Creek.

39. **Aplopappus gracilis** Gray, Pl. Fendl., 76.

Type locality: "Along Santa Fé Creek." No. 393.

Collected on the sandy flats of the San Juan River, near the junction with McElmo Creek; rather rare.

40. **Solidago Canadensis** L., Sp. Plant., 878.

Type locality: "Virginia and Canada."

A specimen from Butler Spring agrees very well with the typical form. One from the cliffs near Bluff City is more closely allied to var. *scabra*. The leaves are few, lance-oblong, entire, obscurely triple-nerved, distinctly scabrous, slightly hispid on the margins; heads 3 mm. in diameter, outer bracts of the involucre obtuse, inner, acute. The plant grows to a height of three or four feet; the clusters of the panicle are spreading and open.

41. **Townsendia incana** Nutt., Trans. Am. Phil. Soc., N. S., vii (1841), 306.

Type locality: "On the Black Hills (or eastern chain of the Rocky Mountains) near the banks of the Platte."

The flowers of the plants growing on the stony mesa above Butler Spring were larger than in the typical form, with pappus of the ray flower one-third smaller than that of the disk flowers.

42. **Aster spinosus** Benth., Pl. Hartweg., 20.

Type locality: "North of the City of Mexico on the way to Zacatecas."

Collected in Willow Creek Cañon where water seemed to be constant, growing in a large clump, 3 or 4 feet in

height. This is the most northern station reported for this species. I saw only the one plant.

43. **Aster multiflorus** ([Dryand. in] Ait. Hort. Kew., ed. i, iii, 116. North America and Mexico). (Copied from Index Kewensis.)

This widely distributed species was found near the head of Willow Creek. It had few flowers and looked starved.

44. **Aster lævis** L., Sp. Plant., 876.

Habitat: "North America."

Collected near the head of Willow Creek, foliage sparse, leaves below the inflorescence 3 cm. long, less than 3 mm. wide; heads scattered at the ends of the branchlets.

45. **Aster canescens** Pursh., var. **aristatus** n. var.

This seems to combine characteristics of several of the described varieties. Glandular, scabro-hispidulous, densely so above; bracts of the turbinate involucre appressed and aristate, lowest, slightly squarrose; heads few at the ends of the branchlets; leaves diminishing upwards, upper ones appressed to the stem, bristly-ciliate;

48. Erigeron sparsifolius n. sp.

About 6 dm. high, 3 or 4 erect stems from a woody taproot, probably perennial, the new growth springing from the buds below, on the stems of the previous year; canescent when young, later becoming greener as the short white appressed hairs become more scattered; radical leaves drying early, lowest stem leaves 5 cm. long, oblanceolate, tapering to the margined petiole, which broadens to a persistent spoon-shaped base; leaves diminishing upwards, narrowly linear above, inclined to twist; heads few, cymose, 5 mm. high; bracts of the involucre in 3 series, loosely appressed, lanceolate, acuminate, outer short bracts white-hairy; inner glandular, ribbed; rays about 16, light blue, 5 mm. long, 1 mm. wide, acute or slightly toothed at the apex; disk flowers numerous; tubular corolla slightly hairy, yellow, becoming ochroleucous, 5-toothed, with thick margins; pappus of ray and disk compound, scabrous, inner fragile, equaling the corolla; akenes 4-angled, slightly hairy; receptacle convex.

This Erigeron was collected at the head of Willow Creek, July 14, 1895. It is nearest to *Erigeron Parishii* and *E. Utahensis*, but has much smaller heads than either and a different habit of growth.

Type in the Herbarium of the California Academy of Sciences.

49. Another form was collected with more numerous and more slender stems, fewer and smaller heads, and outer pappus less evident. The difference is probably due to a less favorable situation. This form was seen between McElmo Creek and the San Juan River, on a dry hillside, and was collected in a dry wash near the head of Willow Creek.

50. **Oxytenia acerosa** Nutt., Journ. Acad. Phila., N. S., i, 172.

Habitat: "Rocky Mountains, near Upper California."

This beautiful plant was always found near alkaline springs. It grows to the height of five or six feet, filling the air with the fragrance of its lilac-scented flowers. The large yellow panicles are conspicuous, and can be recognized from afar. The lower leaves are not rigid, as in the type description, and not at all revolute. They have 5–7 lax alternate segments of varying lengths, some about 12 cm. long. The upper leaves are more rigid, Collected at an alkaline spring near the junction of Montezuma Cañon with the San Juan River; seen also along McElmo Creek and on Epsom Creek near one of the springs of bitter water.

51. **Dicoria paniculata** n. sp. Plate xlv.

Annual, 3–4½ dm. high, branched from the base, sometimes simple, branches opposite, below becoming alternate, spreading outwards and upwards; whole plant hispid-canescent, with jointed, appressed hairs; leaves lanceolate, obtuse, entire, or sparingly dentate, from 8 cm. long to less than 2 cm., with petioles about 1 cm. long,

membranous, slightly hispid, 5-toothed; young akenes obovate, hairy, with an inconspicuous toothed margin; mature akenes oblong, keeled on the back, concave on the face, but rigid; 6 mm. long, dark brown, irregularly dentate with horny teeth lighter on the edge but not scarious or membranous; pappus a tuft of short hairs; stigmas elongating with the growing akene.

This is close to *Dicoria Brandegei*, and occupies the same sandy flats along the San Juan River near the junction with McElmo Creek. *D. Brandegei* is very abundant and blooms later than this species. The flowers of this species are more numerous than those of *D. Brandegei*, and there are two fertile flowers to each head instead of one. In the akene the teeth of *D. Brandegei* are said to be connected by an indistinct scarious margin; in this the teeth are not connected except at the base and are more horny there than at the edge.

Type in the Herbarium of the California Academy of Sciences.

52. Dicoria Brandegei Gray, Proc. Am. Acad., xi, 76.

Type locality: "Along the San Juan, between McElmo and Recapture Creeks."

Among the hundreds of plants of this species which I saw, there were only two barely coming into bloom. It is conspicuous because of its abundance, its widely spreading habit and its white-veined leaves. Some of the plants cover an area nearly a yard in diameter.*

This was collected at the type locality.

* I have scraps of what appears to be a fourth species of *Dicoria* collected by Mr. Alfred Wetherill in the same region, which I name after the discoverer.

D. WETHERILLII n. sp.

Bracts conspicuous, broad, hood-shaped, loosely inclosing the akene,

53. **Ambrosia.**

This is either a new species or a variety of *A. artemisiæfolia*. It is too young for satisfactory determination. The plant collected is annual, 9 dm. high, branching; the sterile heads have pedicels 2 cm. or less in length; the 5-lobed involucres are open-campanulate, 5 mm. in diam., and surpass the staminate flowers; the pistillate flower has a beak a little over 1 mm. in length.

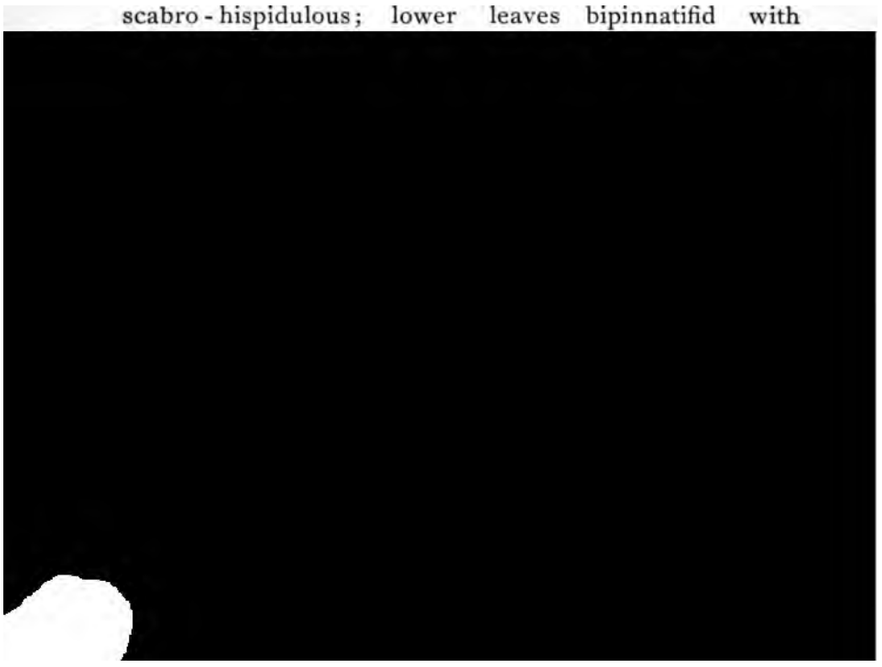
Collected in Willow Creek Cañon where it seemed rare; seen in no other place.

54. **Franseria Hookeriana** Nutt., Trans. Am. Phila. Soc., N. S., vii, 345 (1841). First described as *Ambrosia acanthocarpa* Hook., Flor. Bor. Am., i, 309.

Type locality: "Near the sources of the Colorado of the West."

Two forms of this variable species were collected in the same locality differing considerably from each other. Not having access to the types of this polymorphous species I cannot tell which form is nearest, so it seems best to describe both.

55. Annual, erect and simple up to the inflorescence; scabro-hispidulous; lower leaves bipinnatifid with



leaves oblong, pinnately-parted; staminate flowers in heads 4 mm. in diameter, 15–20 flowered, glandular spot on the involucre inconspicuous, spike not dense.

56. Annual, branched from the base with several stems, which are simple up to the inflorescence, canescent with appressed hairs; leaves smaller than the last, on shorter petioles, similar in general outline and in the divisions; staminate heads 3 mm. in diameter, in a dense spike 12–15 flowered; glandular ridge on the involucre prominent. The fruit in both is so immature that differences cannot be noted.

Collected in Willow Creek Cañon.

57. **Wyethia scabra** Hook., Lond. Journ. of Bot., vi, 245.

Type locality: "Clayey argillaceous declivities of the high hills of the upper Colorado River."

Collected on a branch of McElmo Creek near the bottom of the gulch; also, near the head of Willow Creek, on the side of a low hill. Both sides of the leaf are alike, and the tendency to assume the upright meridional position is marked. This is true also of other species of *Wyethia*.

58. **Helianthus petiolaris** Nutt., var. **canescens** Gray, Pl. Wright., i, 108.

Type locality of the variety: "Valley of the Rio Grande, sixty or seventy miles below El Paso."

This plant, judging from my specimens, connects *H. petiolaris* Nutt. with *H. annuus* L.

In the field it suggests a small form of *H. annuus* with canescent foliage. The shape of the leaves and manner of growth and branching ally it with that species, while the bracts of the involucre, the pappus scales and the size and shape of the head, show its relation to *H. petiolaris*. The plants grow to a height of from 4–5 dm. There is

some variation in the amount of pubescence. one specimen is much more canescent than the other and the leaves have longer petioles. In the lower leaves the petioles are from 2–3 cm. long. sometimes surpassing the blade. sometimes not equaling it.

It was abundant on the mesa above Butler Spring.

59. Encelia frutescens Gray. Proc. Am. Acad., viii, 657.

Described as *Simsia frutescens* in Bot. Mex. Bound., 89.

Type localities: "Agua Caliente. on the Gila." "Sierra Prieta. near Fort Yuma."

Collected near Butler Spring: very scabrous. rayless, and without pappus awns.

60. Thelesperma gracile Gray. Hook. Kew Journ., i. 252.

Described as *Bidens gracilis* Torr., in Ann. Lyc., New York. ii. 215.

Type locality: "On the Canadian."

Collected at Butler Spring: seen also in other places.

61. Hymenopappus filifolius Hook., Fl. Bor. Am.,

Redescribed by Gray in Pl. Wright., i, 117, from specimens collected by Fendler on hills of the San Pedro River.

Collected in the cañon of the San Juan River near the junction with Willow Creek; also, on hills above the cañons branching into the San Juan.

64. **Senecio multilobatus** Torr. & Gray, ex. A. Gray in Pl. Fendl., 109.

Type locality: "Abundant on the Uintah River, in the interior of California." Fremont (second exped.).

This is common in southeastern Utah, and was collected in fruit near the head of Willow Creek. The divisions of the leaves are almost entire.

65. **Cnicus Rothrockii** Gray, var. **diffusus** n. var.

Stems forming a clump from a root apparently perennial, 6 to 9 dm. high, slender, leafy, glabrous except for some slight deciduous tomentum; radical leaves pinnately-parted on long petioles, divisions not crowded, irregularly lobed with spreading lobes, spinous-ciliate with longest and stoutest spines at the ends of the largest divisions, 3 to 4 dm. long, petiole equalling the blade, spinous-ciliate to near the base; cauline leaves similar but smaller, decurrent from the base of one leaf almost to the next; heads either solitary at the ends of the branches or two or three cymosely clustered; involucres 2 to 2½ cm. long, 1 cm. wide at the base, gradually contracted upwards in the young heads; as the flowers grow older, spreading outwards; bracts slightly tomentose in 7 ranks, outer armed with slender spines from 1 to 1½ cm. long, inner filiform, acuminate; spines spreading or even reflexed in age; heads of 30 to 40 purplish flowers, exserted much beyond the involucre; slender divisions of the corolla half its length, abruptly acuminate at the apex; node of

the stigma 2 mm. from the tip; pappus almost equalling the corolla; seed mottled with brown, polished, flattened.

This beautiful Cnicus differs from Lemmon's 2794, collected in the Huachuca Mts., Arizona, which is named *C. Rothrockii*. Its bushy habit, leaves more decurrent with fewer and broader divisions, and heads longer and more slender at the ends of leafy branchlets, give it such a different appearance that I hesitated about making it a variety. It grew in the dry sandy washes at the heads of the deep cañons that formed the numerous laterals of the San Juan Cañon. The head of Willow Creek is the type locality, and there it was most luxuriant owing to the greater amount of water that is generally present, coming from the finest spring in that arid region.

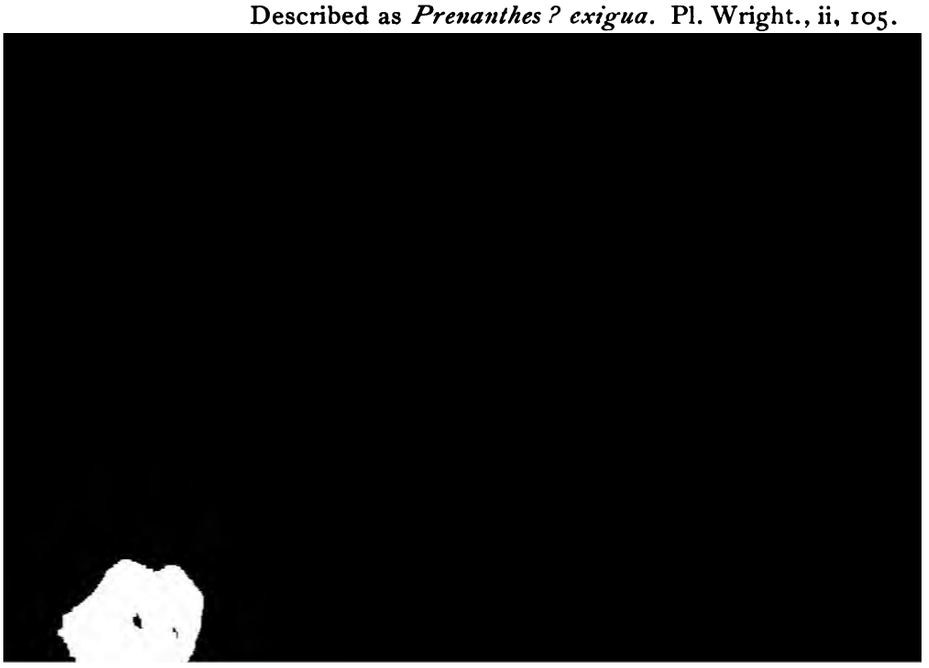
66. **Stephanomeria pentachæta** Eaton, Bot. King's Exped., 199, t. xx, figs. 8–10.

Type localities: "Truckee and Humboldt Valleys."

Collected along the San Juan River below McElmo Creek.

67. **Lygodesmia exigua** Gray, Proc. Am. Acad., ix, 217.

Described as *Prenanthes? exigua*. Pl. Wright., ii, 105.



are from 8–17 cm. The plants were all in fruit. One was found with a belated crimson flower. This was part of the interesting vegetation high up on the moist bench of the cliffs near Bluff City; a stranded relic of boreal vegetation in a region of sonoran plants, and cut off by an altitude of several hundred feet from the riparian flora below.

69. **Fraxinus anomala** Torr., ex S. Watson in Bot. King's Rep., 283.

Type locality: "Labyrinth Cañon, Colorado River."

This was common throughout the region, growing on the edge of cañons and in the depths below. Collected in fine fruit in McElmo Cañon. The wood of this ash is much darker in color than is usual in this genus.

70. **Forestiera Neo-Mexicana** Gray, Proc. Am. Acad., xii, 63.

Described first as *F. acuminata* var. *parvifolia* Gray, Proc. Am. Acad., iv, 364.

Type localities: "New Mexico, near Santa Fé, Fendler, No. 547; below El Paso, Wright, No. 1699; Semelenque Springs, Dr. Bigelow (in Mexican Bound. Coll.)."

Collected in fruit on the San Juan River and along the bitter springs of Epsom Creek. It is abundant wherever it grows.

71. **Apocynum cannabinum** L., Sp. Pl., i, 213 (1752).

Habitat: "Canada and Virginia."

Collected on the banks of the San Juan River near the Willow Creek Junction. The cymes are few flowered, loosely and very slenderly branched, minute bracts are numerous.

72. **Amsonia angustifolia** Michx., var. **Texana** Gray, Syn. Fl., 81.

Type locality: "Texas, in rocky prairies and at the base of limestone cliffs."

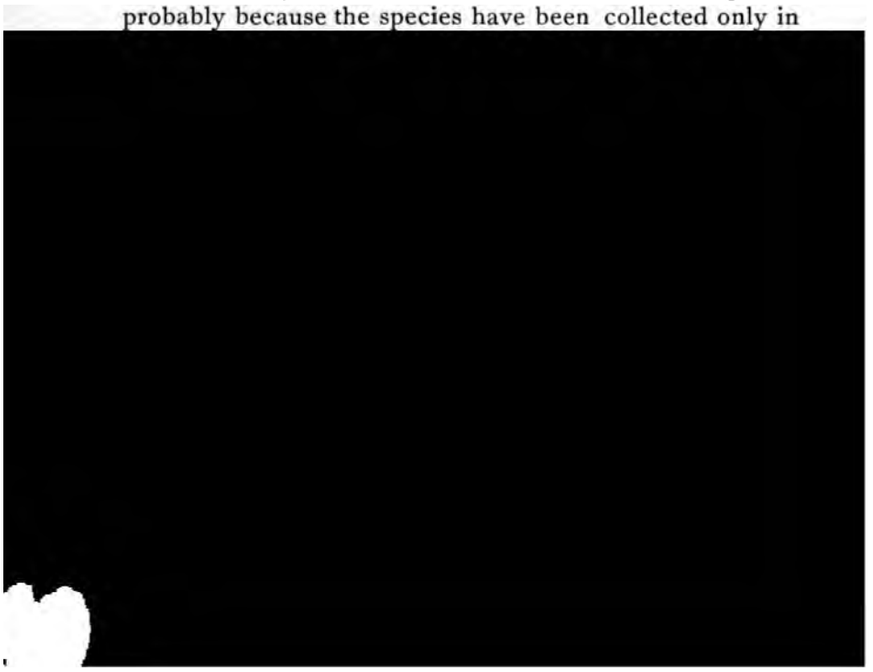
The seeds of this species are cylindrical, obliquely truncate at each end, corky; embryo fills the cavity of the seed.

73. **Amsonia brevifolia** Gray, Proc. Am. Acad., xii, 64.

Type localities: "Southern Utah and Western Arizona to the borders of California."

These specimens collected in Willow Creek Cañon have narrower leaves than typical *A. brevifolia* with which it has been compared by Mr. M. L. Fernald at the Gray Herbarium. The moniliform follicles show no tendency to break into one-sided joints when ripe. Instead, they flatten out after the seeds are discharged, becoming conspicuous with their translucent texture and varnished surface. The seeds are fusiform, obliquely truncate at each end, light chocolate brown, faintly ribbed, with a depression on one side. The seed coat is corky, with embryo not filling the cavity. It was seen only in fruit, but is quite common in Willow Creek Cañon and was met with nowhere else on the route.

As the seeds seem so characteristic, I have described them minutely. Descriptions of the seeds are not given, probably because the species have been collected only in



shade; body of the seed under the lens marked with fine membranous, crenate or broken ridges, radiating from the axis. I can find no description of the seed of *A. involucrata*, nor have I any fruiting specimens for comparison. This is widely distributed, as I collected the same variety near the head of Willow Creek and on Barton's Range.

75. Asclèpias stenophylla Gray, Proc. Am. Acad., xii, 72 (1876).

Described first as *Polyotus angustifolius*, by Nuttall in Trans. Am. Phil. Soc., N. S., v, 201.

Type locality: "In dry prairies, from Fort Smith to Red River."

Collected in flower and fruit in Willow Creek Cañon. The plants grew to a height of 3 or 4 feet. In the fruiting specimen collected the pedicel is curved downwards and the follicle is erect.

76. Frasera Utahensis Jones, Zoe, ii, 13.

Type locality: "Buckskin Mountains (Kaiba Plateau), on the southern edge of Utah."

Specimens were collected near the head of Willow Creek, growing to a height of four or five feet, with thick hollow stems; flowering branches widely spreading above. This was noted also on the sands of a branch of Epsom Creek where *Psoralea juncea*, etc., were found.

77. Gilia longiflora Don, Gen. Syst., iv, 245.

First described as *Cantua longiflora* Torr., Ann. Lyc., N. Y., iii (1828), 221.

Type locality: "On the Canadian River."

This is described as glabrous in the Synoptical Flora, in the original description as "glaberrima." Thurber's specimen, No. 136, is slightly tomentose; Lemmon's plant from the Santa Catalina Mountains is similar; a specimen

collected by myself at Hatch's Wash, southeastern Utah, is glabrous; also one collected by E. L. Greene at Silver City, New Mexico. All are more or less glandular on the calyx; corollas pale blue or lavender.

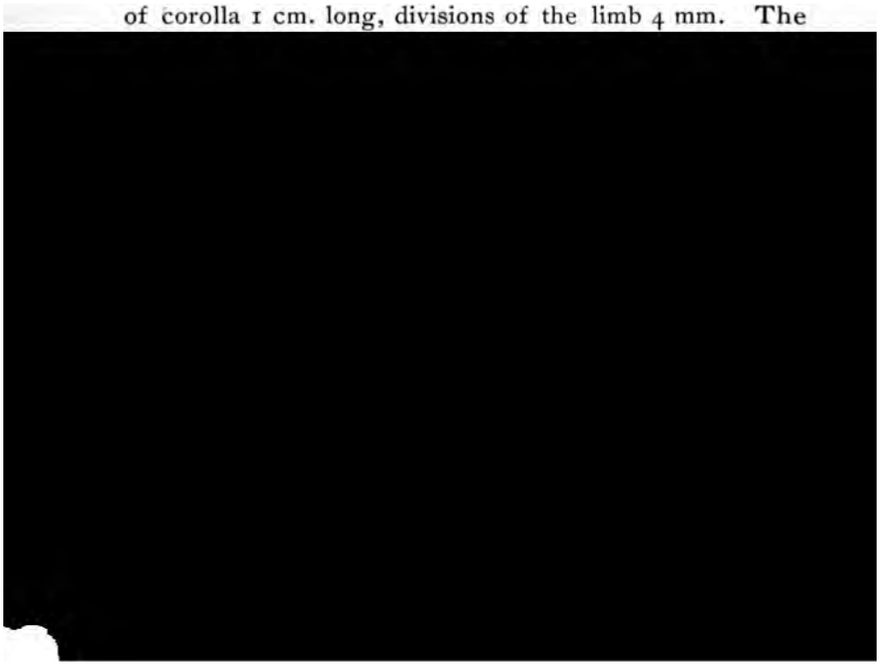
The variety that is found common on the plains around Denver, Colorado, named *Navarettia longiflora* var. *Denverensis* O. Kuntze in Revis. Gen. Plant., ii, 432, is slightly glandular throughout, and differs from the long-flowered type in the diffuse branching habit as well as much smaller flowers. Hall & Harbour's 558 is the same variety.

Specimens collected under the cottonwoods of the San Juan River, below McElmo Creek, are sparingly tomentose; flowers large, with the tube of the corolla 4 cm. long, limb of largest 2 cm. in diameter, corolla divisions obtuse or abruptly pointed at apex.

78. Gilia multiflora Nutt., Journ. Phil. Acad. Sci., i, 154.

Type locality: "Sandy hills along the borders of the Rio del Norte, New Mexico."

Collected on the San Juan River below McElmo Creek. Only one plant seen, with stamens barely exserted, tube of corolla 1 cm. long, divisions of the limb 4 mm. The



sence of woolly pubescence, divisions of leaves fewer, aristate; upper part of stem, calyx and bracts glandular-pubescent, tube of the corolla slightly surpassing the aristate divisions of the calyx.

81. Gilia pumila Nutt., Journ. Phil. Acad. Sci., N. S., 1, 156.

Type locality: "Near the first range of the Rocky Mountains of the Platte."

Collected on McElmo Creek. Common.

82. Gilia aggregata Spreng., Syst. Veg., i, 626 (1825).

Described first as *Cantua aggregata* Pursh., Fl., i, 147 (1814).

Type locality: "On the banks of the Mississippi."

A peculiar specimen of this species was collected near the head of Willow Creek, showing in its less dissected foliage the effects of a desert environment. The leaves have 3–10 divisions, 1–2 mm. wide, those on the middle of the stem being lanceolate phyllodia 3 mm. wide, 2 cm. long; the flowers are few, in a virgate panicle.

83. Gilia leptomeria Gray, Proc. Am. Acad., viii, 278.

Type locality: "Mountain valleys of Nevada and Utah."

Collected along McElmo Creek and the San Juan River. From some of the specimens I am inclined to believe *Gilia Triodon* Eastwood, Zoe, iv, 121, to be a variety of this species.

84. Gilia inconspicua Dougl. in Hook. Bot. Mag., t. 288.

Type locality: "Sandy barrens on southern branches of the river Columbia."

Collected on Barton's Range, on a mesa near Epsom Creek.

85. **Gilia subnuda** (Torr. in Herb.) Gray, Proc. Am. Acad., viii, 276.

Type range: "Nevada and Arizona or New Mexico."

This is the form with orange flowers tinged with crimson. It is glandular throughout; the only radical leaf on the single plant seen is obovate, crenate and dentate.

Collected near the head of Willow Creek.

86. **Gilia Haydeni** Gray, Proc. Am. Acad., xii, 79.

Type locality: "High plains of the San Juan, southwestern Colorado or adjacent Utah."

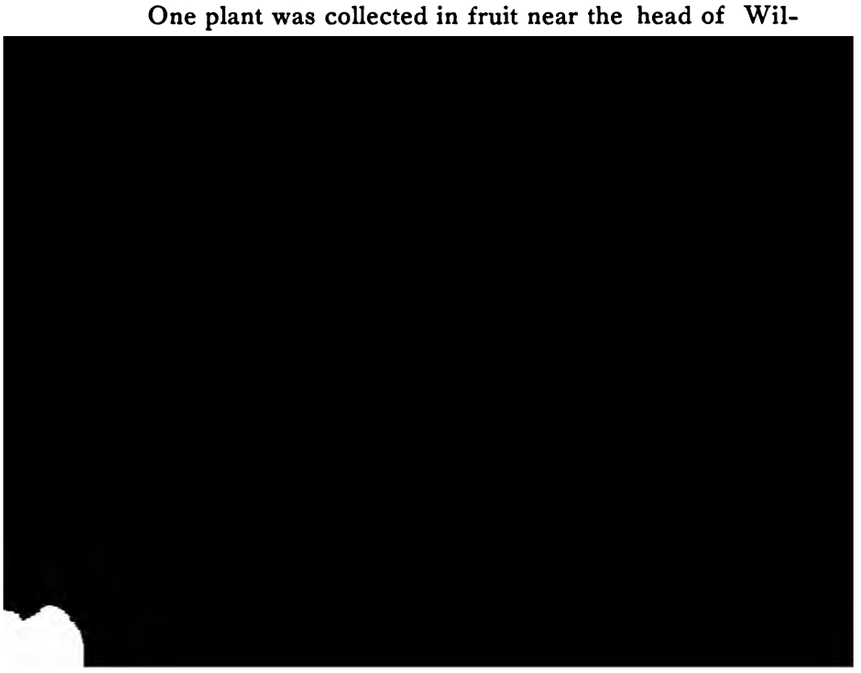
This specimen, collected near the type locality, does not agree so closely with the description as plants previously collected near Mancos, Colorado.

It is glandular throughout, especially above. The corolla is faded pink (due perhaps to age or poor nutrition) instead of bright crimson. The plant looks starved and evidently has put forth a second crop of flowers, as other species of the genus do when a rain succeeds a drought.

87. **Phacelia crenulata** Torr., ex Watson, Bot. King's Exped., 251.

Type locality: "Trinity Mountains, Nevada."

One plant was collected in fruit near the head of Wil-



Type locality: "On the sandy banks of the Arkansas."

Collected near Bluff City, noticed in other places along the route. In bloom during the day, filling the air with fragrance. The fruit in my specimens is woolly rather than hairy or pubescent; corolla with limb nearly 15 mm. in diameter.

90. **Krynitzkia Jamesii** Gray, Proc. Am. Acad., xx, 278.

First described as *Myosotis suffruticosa* Torr., Ann. Lyc. N. Y., ii, 225 (1828).

Type locality: "Barren deserts near the Platte."

Collected on a rocky hill on Barton's Range, between Epsom and Willow Creeks. This plant is more than 3 dm. in height, smoother than the typical form, with prominent postules on the leaves; spikes of flowers loosely branched.

91. **Cuscuta arvensis** Beyrich.

Described as *C. Americana?* in Hook., Fl. Bor. Amer., ii, 77, identified with *C. arvensis* Beyrich, in Herb. Nostr.

Type range: "Northwestern America," Douglas.

This was found growing on *Xanthium strumarium* L., along the San Juan River; not seen elsewhere.

92. **Physalis Fendleri** Gray, Proc. Am. Acad., x, 66.

Type locality: "Rocks and plains of New Mexico."

Collected and seen only in a shallow gulch on the stony mesa above Butler Spring.

93. **Lycium pallidum** Miers, Ann. & Mag. Nat. Hist., Ser. 2, xiv (1854), 131.

Collected along McElmo Creek in fruit. Red berries nearly 1 cm. in diameter.

94. **Lycium Andersoni** Gray, Proc. Am. Acad., vii, 388.
Type locality: "Southeastern part of the State of Nevada."
Collected in abundant fruit on Barton's Range, where it was common. Berries light red, about 6 mm. in diameter.

(**Datura meteloides.** DC., Prod., xiii, 544.
Type locality: "In warm regions of New Spain."
Abundant in some localities along the San Juan River. Not collected.)

95. **Pentstemon Bridgesii** Gray, Proc. Am. Acad., vii, 379.
Type locality: "Yosemite Valley."
Collected near the head of Willow Creek, apparently rare.

96. **Mimulus cardinalis** Dougl., Lindl. Hort. Trans., ii, 70 (1842).
This plant seemed strangely out of place. It was an inhabitant of the bench on the cliffs near Bluff City. It is smaller than the Californian plant, much more villous and has dentate leaves.

99. **Poliomintha incana** Gray, Proc. Am. Acad., viii, 296.

First described as *Hedeoma incana* Torr., Mex. Bound. Surv., 130.

Type locality: "Sandy places near El Paso, Texas."

Collected on a sandy wash, a branch of Epsom Creek, growing on sandy knolls. The sands appear to have drifted around the woody stems, thus forming the knolls.

100. **Hedeoma Drummondii** Benth., Lab. Gen. et Spec., 368.

Collected in fruit near the head of Willow Creek.

101. **Oxyaphus angustifolius** Sweet. var. **viscidus** n. var.

This plant, collected at Butler Spring, resembles the typical plant as described in Mex. Bound. Surv., 175, and Bot. King's Rep., 284, except in the glandular villosity of the peduncles, pedicels and involucres. The seeds are tuberculate between the ribs.

102. **Allionia incarnata** L., Syst. ed. x, 890.

Locality not given.

Collected on hills beyond Epsom Creek and in Willow Creek Cañon. Not common.

103. **Abronia Cycloptera** Gray, Am. Journ. Sci., Ser. 2, xv, 319.

Type locality: "On the Rio Grande, New Mexico."

This species was well distributed throughout the region. Collected at Butler Spring.

104. **Abronia turbinata.** var **marginata** n. var.

This variety has leaves elliptical to ovate-lanceolate, obtuse to acuminate, margins scabrous, lighter in color, inclined to be involute; involucral bracts membranous, elliptical, acute, 8 mm. long, 5 mm. wide, peduncles

and pedicels slender, deflexed, spreading, surpassing the leaves; flowers white or tinged with rose color, fragrant.

A. turbinata, so well marked by the peculiar fruit, seems to be a variable species. I have specimens from Grand Junction, Colorado, that are distinguished by large conspicuous involucral bracts.

Collected on the mesa above the San Juan River, beyond Butler Wash. It was very abundant but only one specimen was collected.

105. **Abronia fragrans** Nutt. ex Hook., Kew. Journ., v (1853), 261.

Type locality: "On loamy, sandy, firm banks, within the high drift-sand hills of the Lower Platte."

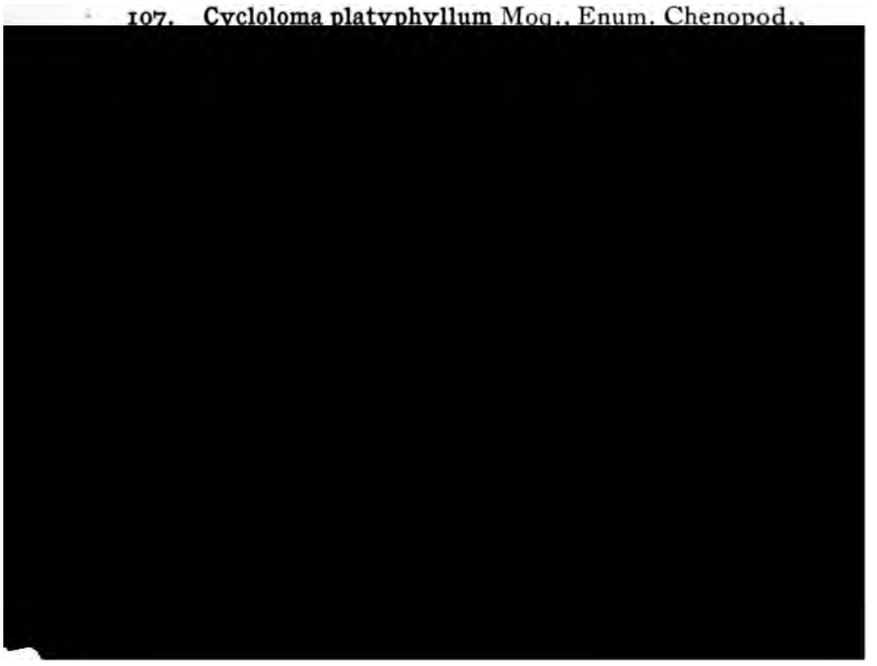
Collected on McElmo Creek, within the cañon, where it was abundant.

106. **Cladothrix lanuginosa** Nutt., ex Moq. DC., Prod., xiii, 2, 360.

Type localities: "Salt River and Red River."

Collected near the junction of the San Juan River with McElmo Creek; also on Barton's Range, beyond Epsom Creek.

107. **Cycloloma platyphyllum** Moq., Enum. Chenopod.,



109. **Chenopodium leptophyllum** Nutt.! in Herb. ex Moq., DC. Prod., xiii, 2, 71.

Type locality: "In Nova-California." (Nutt.!)

Collected near the head of Willow Creek; common throughout the region. Either simple or much branched.

110. **Atriplex.**

This plant, collected on McElmo Creek, is too young for determination. It is perennial and dicœcious, but in leaves and habit of growth it does not agree with any described in that group.

111. **Atriplex Powellii** Watson, Proc. Am. Acad., ix (1874), 114.

Type described from plants raised from Arizona seeds. This was immature and therefore is doubtful.

Collected near Recapture Creek.

112. **Atriplex truncata** Gray, Proc. Am. Acad., viii, 398 (1873).

First described by Torrey as *Obione truncata* in Bot. King's Exped., 291.

Type locality: "Near Carson City, Nevada."

Collected in immature specimens along the San Juan flats near Recapture Creek.

113. **Atriplex canescens** James, Cat., 178.

First described by Pursh as *Calligonum canescens*, in Fl. of N. Am., 370 (1816).

Type locality: "In the plains of the Missouri, near the Big Bend."

Common throughout the region on alkaline flats, commonly known as "salty sage." Abundant on McElmo Creek.

114. **Atriplex confertifolia** Watson, Proc. Am. Acad. ix, 119 (1874).

Described first as *Obione confertifolia*, by Torrey, Frem., 2d Rep., 318 (1845).

Type locality: "On the borders of the Great Salt Lake."

Widely distributed in alkaline soil and collected on McElmo Creek.

115. Atriplex cornuta Jones, Proc. Cal. Acad. Sci., 2d Ser., v, 718.

Type locality: "Green River, Utah, in clay."

This was collected on the alkaline flats of the San Juan River, between Montezuma Creek and McElmo Creek; also on McElmo Creek.

This is very close to *A. argentea* Nutt., but the leaves are much thinner, the horns or processes on the fruiting bracts more numerous, longer and more lobed.

116. Atriplex Caput-Medusæ n. sp. Plate xlvi.

Annual, with several erect stems from the base, about 4 or 5 dm. high, intricately branched with slender, generally upward-spreading branches; loosely scurfy throughout, leaves rather thin, vertical, on petioles half as long as the blades; lower leaves deltoid with obtuse apex and rounded basal angles; upper becoming smaller, deltoid

of in terminal clusters. The fruiting bracts are not compressed and the horny appendages are so numerous that it is impossible to distinguish the margins from the sides of the bracts. The name was suggested by a fanciful resemblance of the fruit to the Gorgon's head.

117. Another form growing in the same region is smaller with fewer branches, leaves thicker, more appressed-scurfy; the fruiting bracts have shorter processes disposed to be somewhat spine-tipped; the pedicels are stouter and less attenuated. It appears to be a starved, less protected plant than the type, and from its open situation I judge this to be the explanation of the difference rather than to consider it even a variety.

The type was collected near Recapture Creek, along the banks of the San Juan River, growing in masses mixed with other species of *Atriplex*, etc. The smaller form grew in the open where the ground was drier and less fertile.

118. **Grayia Brandegei** Gray, Proc. Am. Acad., xi, 101.

Type locality: "Hillsides, among fragments of cretaceous sandstone on the San Juan River, near the boundary between Colorado and Utah."

Collected abundantly in a similar locality on a hill opposite Hill's Ranch, on McElmo Creek not far from the boundary, probably the type locality.

It was abundant there, but seen in no other place; though I was on the lookout for it constantly. Two forms grow together apparently under the same conditions.

(a) This grows to a height of 4–5 dm.; leaves, including the petiole, 3–4 cm.; fruiting bracts 4–6 mm. wide.

(b) This is less than 2 dm. in height; leaves not exceeding 2 cm. in length, inclined to be revolute espec-

ially at the upper part of the stem; fruiting bracts 4 mm. wide, more furfuracèous-canescent than *(a)*.

June 3, 1892, I collected this species in flower in the same locality. It is monœcious; staminate flowers with five rhomboid divisions curled inwards, yellow, fading to white at the margin; 1½ mm. long, 1 mm. wide; the pistillate flowers are lepidote, cylindrical, with long styles.

(**Grayia polygaloides** Hook & Arn. Bot. Beech. Voy., 387.

First described as *Chenopodium? spinosum* Hook., Fl. Bor. Am., ii, p. 127.

Type locality: "Interior of California."

Widely distributed but not collected.)

(**Eurotia lanata** Moq. Enum. Chenopod., 81.

First described as *Diotis lanata* Pursh, Fl. N. Am., 602 (1816).

Type locality: "On the banks of the Missouri in open prairies."

This is widely distributed, but not abundant in any particular locality. Not collected.)

119. Sarcobatus vermiculatus Torr., Emory's Rep., 149

of the Platte to northern Nevada, and south to northern Mexico and southern California."

Collected on McElmo Creek, widely distributed through the region.

The seeds are found stored in the Cliff Dwellers' ruins, and were probably used as food. The Utes and Navajos of the adjacent reservations are said to collect them at the present time for food.

121. **Eriogonum alatum** Torr., Sitgreaves' Rep., 168, t. viii.

Type locality: "On the Zuni River."

Collected in fruit near the head of Willow Creek.

122. **Eriogonum cernuum** Nutt. Journ. Phil. Acad. Sci., N. S., i, 162.

Habitat: "On the plains of the Oregon and in the Rocky Mountains."

Collected on McElmo Creek; also noted along the San Juan. It is a widely spread species, usually abundant.

123. **Eriogonum cernuum** var. **umbraticum** n. var.

This differs from the typical form in several characteristics. Stems leafy almost to the inflorescence, pedicels longer and more slender, spreading downwards rather than deflexed, ½–2 cm. long, outer divisions of the perigonium obcordate and less spreading.

This was collected along the San Juan River, between McElmo and Montezuma Creeks. It grew in the shade of the cottonwoods, hence the varietal name. I collected it in 1892 along McElmo Creek. It seemed rare.

124. **Eriogonum Wetherillii** n. sp.

Leaves orbicular, obtuse or obliquely truncate at base, tomentose below, sparingly so above, 10 mm. in diameter, on tomentose petioles somewhat longer than the blade;

bracts at the nodes ternate, triangular, obtuse, ½ mm. or less in length, turbinate; obtuse teeth four; 4–6 flowered; glabrous without, conspicuously white-villous within; perigonium ⅔ mm. long, yellow, with reddish ribs, becoming rose colored in age, open-campanulate, glabrous, exserted on a slender stipe; outer segments obovate; inner oblong, narrower and longer; seed flattened, lens-shaped, brown, with a varnished surface.

This belongs to § *Pedunculati*, near *E. Thomasii*, from which it differs in the shape of the segments of the perigonium, the glabrous flowers and more flattened seed. In habit the two species are so similar as to be confused.

This Eriogonum forms a tumble-weed 10–20 cm. in diameter, because of the numerous intricately-branched stems which spread out near the base. The lower and chief internodes are about 2 cm. long, while at the ends of the branches they about equal the capillary pedicels (about 5 mm. long). The pedicels are conspicuously perpendicular to the stem, the branches less so. The entire plant becomes reddish with age. It grows at the base of sandstone cliffs along the San Juan River. I collected it also in a similar situation, near Moab, on the

126. **Eriogonum divaricatum** Hook., Journ. of Bot. & Kew Gard. Miscell., v, 265.

Type locality: "On saline clayey soils, within the high calcareous hills of the upper Colorado."

Abundant in the same kind of soil as the type, along the San Juan River, in a limited space, where probably the soil suited its needs.

127. **Eriogonum flexum** Jones, Zoe, ii, 16.

Type locality: "On the Moencoppa, in northern Arizona. It grows on dry mud flats."

This is the plant that I reported (Zoe, iv, 10) as *E. glandulosum*, from Grand Junction, Colorado, and Montezuma Cañon, Utah, not far from where the present collection was made. The environment was similar to that of the type.

128. **Eriogonum Jonesii** Watson, Proc. Am. Acad., xxi, 454.

Type locality: "Cosnino, Arizona, a station on the Atlantic & Pacific Railroad, near the San Francisco Mountains."

This species is variable in size, shape and amount of tomentum, color of flowers, and expanse of cyme. It is very close to some forms of *E. corymbosum*. It was distributed quite extensively from Butler Spring to Willow Creek. I have the three following forms:

129. This was collected on Barton's Range, with broadly elliptical leaves, blade about 3 cm. long, 2 cm. wide, on petioles 1–2 cm. in length, margin revolute, crinkled, tomentose on the lower side, greener above; flowers white; involucres sessile or shortly pedicelled; corymb 3-forked, except on the dichotomous ultimate branchlets. This grows in bunches from a woody base to a height of about 3 dm.

Trees were occasionally seen near the head of the cañons that formed branches of the San Juan. They were low and scraggy and generally solitary.

149. **Epipactis gigantea** Dougl., ex Hook., Fl. Bor. Am., ii, 202.

Range: "Subalpine regions of the Blue and Rocky Mountains." "Columbia River, Ft. Vancouver."

Mr. Brandegee collected this in the San Juan Valley. Hayd. Bull. Geol. & Geog. Surv., ii, 3, 244.

Collected on the moist bench of the cliffs near Bluff City, below Recapture Creek.

150. **Juncus xiphioides** Meyer., Syn. Junc., 50.

Collected near the head of Willow Creek, in the moist earth around the pools.

151. **Andropogon scoparius** Michx., Fl., i, 57.

Habitat: "In aridis sylvarum Carolinæ."

Collected in Willow Creek Cañon; not abundant and seen nowhere else.

152. **Aristida purpurea** Nutt., Am. Phil. Soc., N. Ser., v, 145.

Habitat: "On the grassy plains of the Red River, in arid situations."

ing upwards; upper branches cymosely panicled; involucres few, sessile and secund near the ends of the branchlets (the axillary involucre is shortly pedicelled); perigonium contracted at the throat, forming below, a strongly-ribbed turbinate tube slightly corrugated transversely; divisions orbicular, white, ribbed with rose-color, margin crimped; involucres 3–5 flowered, 2 mm. long, ribs almost concealed by the tomentum.

This belongs to § *Corymbosi* and differs from other members of the group in its well-marked inflorescence. The urn-shaped perigonium allies it most closely to *E. brevicaule*, but in its vegetative characters it most closely approaches *E. corymbosum*.

It was collected on the mesa above Butler Spring where it grew in bunches and presented a beautiful appearance, each plant covering the ground for nearly a yard in diameter with its snowy white intricately-tangled stems.

135. **Shepherdia rotundifolia** Parry, Am. Nat., ix, 350.

Type locality: "On bare clay soil in the upper valley of the Virgen."

This shrub was abundant on the moist benches of the cliffs near Bluff City, and at the head of washes where water remained after a rain. It was collected near Bluff City and near the head of Willow Creek.

136. **Comandra umbellata** Nutt., Gen. i, 157.

Type locality not given.

Collected in fruit on Recapture Creek.

137. **Euphorbia flagelliformis** Engelmann, Hayd. Bull. Geol. and Geog. Surv., ii, 243.

Type localities: "On the Rio Grande, near El Paso."*

* Collected without fruit by Chas. Wright and named *E. petaloidea* var. *flagelliformis* Engelmann, Bot. Mex. Bound., 185.

Collected near the head of Willow Creek. This is an extension of its range, although to be expected; since this flora is similar in so many respects to that of New Mexico and Arizona, where this species is found, according to Vasey. (Gr. of the U. S., 11.)

159. Sporobolus airoides Torr., in Marcy's Rep., 300.

Collected near the head of Willow Creek. It is said to be poor fodder for horses.

160. Equisetum lævigatum A. Br. in Sillim. Journ., 87 (1844).

(Reference not accessible).

Collected near the head of Willow Creek.

161. Adiantum capillus-veneris L.

This cosmopolitan species, found in Europe, Asia, Africa, North and South America, was seen in only one locality, the marshy ground above the pool at Butler Spring.

162. Chara ——.

Collected in the pools near the head of Willow Creek.

EXPLANATION OF PLATES.

PLATE XLIV.

Psoralea juncea.

A. An upper branch, natural size, showing flowers and fruit.
B. A node of the stem, magnified to show the glands, scales, etc.
C. Flower magnified, 10 diameters.
D. Wing magnified, 10 diameters.
E. One of the parts of the keel, magnified 10 diameters.
F. Stamens, magnified 10 diameters.
G. Pistil, magnified 10 diameters.
H. Seedling plant, natural size.
I. First leaf magnified. J. Second leaf magnified.

PLATE XLV.

Dicoria paniculata.

A. Entire plant, natural size. Outline made from two specimens, one simple stemmed and the other diffusely branched; the upper part belonging to the simple stemmed plant, which is paniculate above, the lower branches added from the plant that branched from near the base.
B. Head of flowers magnified.
C. Akene nearly ripe magnified.
D. Corolla magnified.
E. Female flower.
F. Stamens magnified.

PLATE XLVI.

Atriplex Caput, Medusæ.

A. Portion of a branch, natural size.
B. Fruiting bract dissected, showing the position of the seed.
C. Fruiting bract, as seen from the outside; usual shape.
D. Another kind of fruiting bract, found on the same plant.

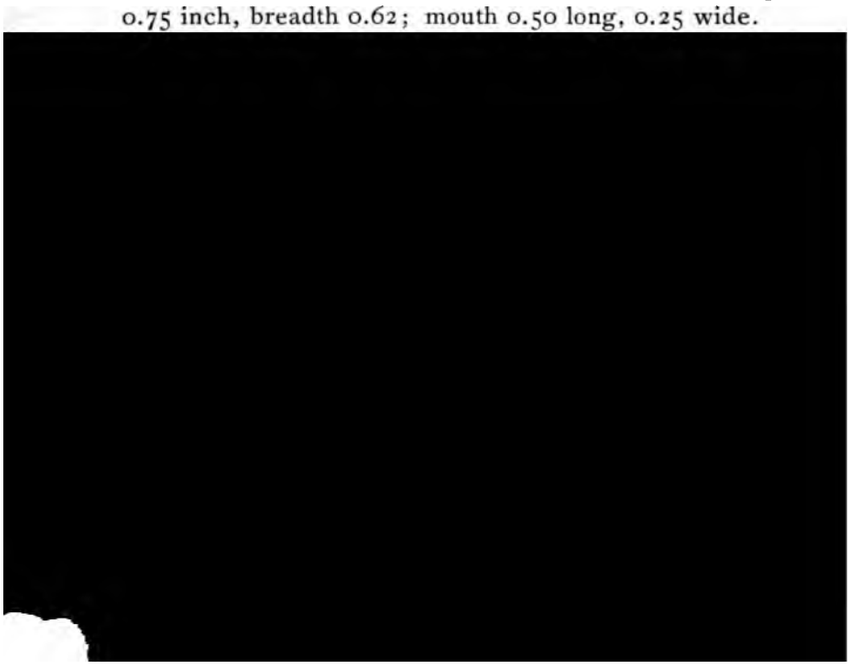
ON SOME NEW CRETACEOUS (AND EOCENE?) MOLLUSCA OF CALIFORNIA.

BY J. G. COOPER, M. D.

[With Plates xlvii and xlviii.]

1. **Sistrum (Ricinula?) cretaceum** n. sp. Plate xlvii, figs. 1 and 2, twice natural size.

Outline obtuse-rhomboid; higher than wide; first whorl nearly flat, smooth, next two turbinate with about 20 nodular strong ribs, crossed by 5 or 6 revolving ribs, the two central strongest, and increasing to about 16 on the fourth or body whorl; lip slightly expanded, with two spinous projections on outer edge formed by the central ribs; inner edge of labrum with three prominent teeth at irregular intervals, and columella with two close together, also one on body-whorl near posterior angle of mouth; some rudimentary teeth also near canal. A young specimen has only four teeth, two on each side of mouth, distributed so as to form the angles of a square; as older ones may develop more, the total dentation is still uncertain. Canal very short, open; spire shorter than mouth. Length 0.75 inch, breadth 0.62; mouth 0.50 long, 0.25 wide.



2. **Littorina subobesa** n. sp. Plate xlvii, figs. 3 and 4, twice natural size.

Outline ovate, less round than that of *L. rudis*, approaching that of *L. obesa* of the Pacific islands, without the subangled base; whorls 4 to 5, rounded, polished, with microscopic revolving impressed lines closely arranged; mouth over half of length, semioval, the columellar margin being nearly straight; imperforate. Length 0.60 to 0.70, width 0.40 to 0.45 inch. Morley, Shasta County, colored brown; Marysville Buttes, yellowish; False Bay, San Diego, blackish. These colors, however, may not have been those of the living shells. The first locality is certainly cretaceous A, the others cretaceous B, or Eocene, containing many species of that age. The shells figured are from the first two localities.

Collected for the Mining Bureau by its assistants, and duplicates presented to the California Academy of Sciences. Those from the second place named have a very fresh appearance but were found in a very hard limestone. I formerly supposed them to be a form of *L. compacta* Gabb, but they seem too different and too uniform in their differences to be so called. I referred to them by that name in my catalogue of San Diego Fossils, Bulletin of Mining Bureau, No. 4, 1894, p. 61.

3. **Calliostoma lignitica** n. sp. Plate xlvii, fig. 5, twice natural size.

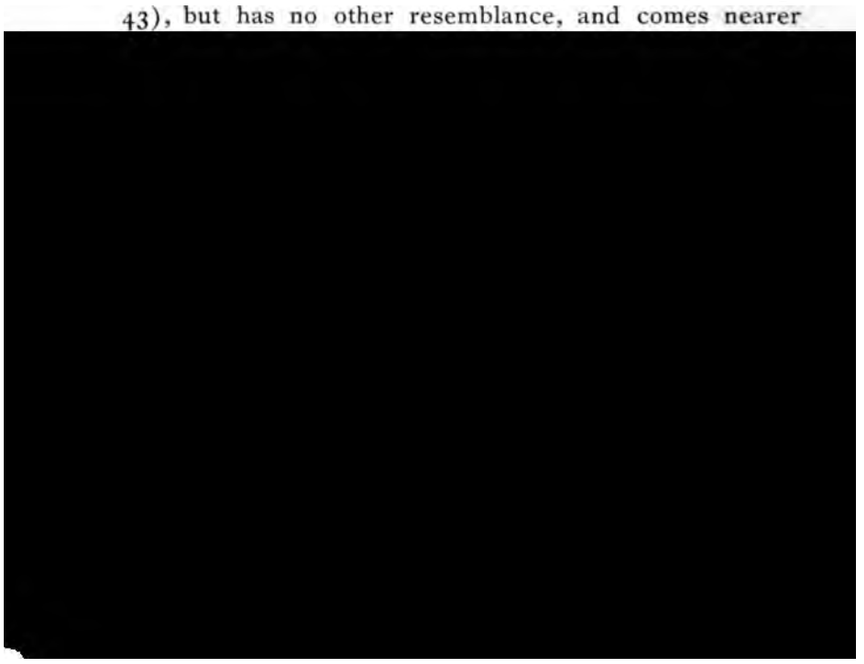
Outline pyramidal; higher than wide; whorls six, first three turbinate, smooth (worn?), fourth with 20 vertical ribs crossed by three strong revolving ribs regularly cancellating the surface and continuing with wider intervals to the body-whorl; upper surface of whorls nearly flat, with a peripheral right angle from which the side of whorl drops vertically; sutures nearly hid by a prominent rib; body-whorl absent from only specimen, but must have

closely resembled the preceding one; height of spire 0.50 inch, breadth 0.50. On the proportionate scale the base of shell must have been about 0.75 inch wide. It much resembled the living *C. gemmulatum* Carp., in form, but differed in sculpture; also differs from the other two species before described from the cretaceous beds of California. Found by W. L. Watts in the head-wall of the San Joaquin coal mine, together with several other species of Cret. A and B.*

4. **Sigaretus costatus** n. sp. Plate xlvii, fig. 6, twice natural size.

Outline oval; whorls about three, the outer enclosing the others, haliotiform; surface covered by about 18 concentric ribs, strong, rounded, and with very narrow intervals between; they appear granulated by intersection of coarse lines of growth. Length 0.45 inch, breadth 0.35, height 0.12.

One specimen from head-wall of San Joaquin Mine. It is filled with asphaltum, coloring it dark brown, and appears similar in form to the *Stomatia intermedia* of San Diego Cret. A (Bulletin iv, 1894, p. 46, pl. 3, fig. 43), but has no other resemblance, and comes nearer



In describing this species the large specimen mentioned by Stanton was not seen by me nor recognized as the adult of the small one figured, but a small single valve like the figure was found, which had one tooth like that of a *Corbula*, from which the genus was published, with very much doubt. The description therefore needs amendment to include the large specimen which is fully twice the size of type. Its length is 0.75 inch at base, breadth 0.55, anterior height 0.60. Beak forming an obtuse point; transverse ribs over 35. It does not closely resemble the figures of species of *Opis* given in textbooks, and to show its resemblance to *Corbula* two better figures of the type specimen are here given, with one of the adult valve. In shape this closely resembles Stanton's *O. californica* in his pl. vii, fig. 3.

Triplicosta n. subg.

With the generic characters of *Pholadomya* (as far as known) and similar in sculpture; the shell is not pearly and thin, but dull and chalky; form like that of Agassiz's section Multicostæ; the ribs even more numerous, covering the whole surface, and of two forms; the posterior, simple, broad and rounded, cover about half the surface, the anterior, formed by division of the broad ones each into 3 or 4, occupy the rest, all diverging from the beaks, with a slight curve backwards, to end at the base. It thus approaches in richness of sculpture the only living species, that of the West Indies, which has three forms of ribs. While some of Agassiz's sections of the genus are stated to be thicker-shelled than others, and pearliness seems not to be universal, it is possible that chalkiness may be caused by fossilization, as it is not often mentioned in descriptions, especially of the West Coast fossils. Though in most points best agreeing with

Pholadomya it may be proved by better specimens to be allied to *Cardita* or *Petricola*, both having species of similar outline and sculpture, but of course very different otherwise. No sign of their strongly toothed hinge is visible in the specimens yet seen.

6. **Pholadomya (Triplicosta) progressiva** n. sp. Plate xlviii, figs. 11 and 12, natural size.

Outline oblong quadrilateral; length varying from nearly twice the height to a little less than height; cardinal area posteriorly well-defined ovate, large; valves gaping moderately behind; umbos moderate, at about $\frac{1}{7}$th of length from anterior end and a quarter of an inch apart; ribs nodular from irregular lines of growth, the posterior broad ones covering from half to two-thirds of surface, and about 10 in number, then each gradually dividing into 3 or 4 narrow sharp ones; the posterior 15 to 18, covering the rest of surface, with intervals equal in width to ribs. The shell seems to have been about one-eighth of an inch thick, and the inside had corresponding rib-like markings. Length of largest 2.75 inch, height 2.50, breadth 2.00.

Found by W. L. Watts, along Santa Paula and Sespi Creeks, branches of the Santa Clara River, Ventura

are found necessary, which I will insert here. The first described was *P. subelongata* Meek, from Vancouver Island cretaceous, in the Transactions of the Albany Institute, vol. iv, p. 42, 1857, and repeated, with a figure, in Bulletin of Hayden's Geog. & Geol. Survey of the Territories, vol. ii, 1896, p. 362, pl. 2. Meek gives the number of ribs as 16 to 25, a wider range of variation than I find admitted in any other species, but whether caused by variation or imperfection of specimens is uncertain. At any rate, the figure shows that it is identical with that described by Gabb as *P. breweri* in the Pal. of Cal., i, p. 152, pl. 22, fig. 123. Gabb was misled by too hasty reference to Meek's first description, for he states that "the marked difference in the number of ribs will at once distinguish them, *P. subelongata* having but 16 ribs." Gabb's second species, *P. nasuta*, may account for Meek's 16-ribbed form, as Gabb gives its range from 12 to 16.

Whiteaves considers both as identical with Orbigny's *P. royana* of France, and states that Orbigny figures the extremes of variation in ribs as from 10½ to 29, which may arise from imperfection in the specimens.

Five specimens from Pt. Loma, San Diego, called *P. breweri* by me in Bull. iv, State Mining Bureau, 1894, are like it in form, but one has the high beaks of *nasuta*, and all have fewer ribs than typical *subelongata*, but have lost all shell, and being internal casts, cannot form certain proof as to the number of ribs once on the outside. The same is probably true of Gabb's *P. oregonensis*. The nearest resemblance to *P. progressiva* is in *P. occidentalis* Morton, from the Cretaceous of N. J. southward, which has 25 to 30 ribs, but none of them triplicately divaricate. But one Eocene species is recorded in the East, *P. marylandica* Con., of which no figure is accessible here.

7. **Cardita alticosta** Gabb. Plate xlviii. fig. 10. natural size.

[1] *Cardita alticosta* Gabb, Pal. of Cal. ii, 268, pl. xxxvi, fig. 16.

The type of this species was from near Arivechi, State of Sonora, Mex. Mr. Watts has found apparently the same species, not rare, in the Cret. B or Eocene beds, along the Sespi branch of the Santa Clara River, Ventura County and I have had one figured for comparison. It is found associated with *C. planicosta* (*C. horni* Gabb), and others of that group of fossils. None of them are perfect enough to show the hinge, but in form and sculpture they seem the same. Three or four others of the Arivechi species have also been found in southern California since they were described.

EXPLANATION OF PLATES.

PLATE XLVII.

Figs. 1 and 2. Sistrum cretaceum n. sp.

Figs. 3 and 4. Littorina subobesa n. sp.

Fig. 5. Calliostoma lignitica n. sp.

Fig. 6. Sigaretus costatus n. sp.

Figs. 7, 8 and 9. Opis triangulata Cooper.

PLATE XLVIII.

Fig. 10. Cardita alticosta Gabb.

Figs. 11 and 12. Pholadomya (Triplicosta) progressiva n. subgen. and n, sp.

NOTE.—The figs. of pl. xlvii, with the exception of No. 7, twice the natural size; those of pl. xlviii, natural size.

Cañon, March 31, 1894. The name *approximans* is used because a majority of these specimens—although considerable variation is shown—have broader snouts and wider supralabial plates than are seen in true *maculata*. I have not been able to see any difference between *H. m. approximans* and *H. m. flavilenta*.

Uta stansburiana Baird & Girard.

This species is represented by seven specimens, all of which were collected at Fort Lowell. They are well within the known variations of this lizard.

Uta ornata Baird & Girard.

The name *Uta ornata* is used because the largest dorsal scales are larger and form more irregular series in these specimens than in *Uta symmetrica* from Fort Yuma, California. Usually the hind limb is not longer than the distance from the posterior gular fold to the vent, but it sometimes exceeds this distance. Most of the males have throat-patches of blue, but some have patches of bright olive-yellow. Others have a central throat-spot of blue changing to green and then to yellow anteriorly and laterally.

One hundred and thirty specimens were secured in

longitudinal dorsal band so often seen in *S. magister*, and the latter is never so generally bluish above as *S. clarkii*.

The number of femoral pores varies from ten to fourteen in *S. clarkii*, from three to four in a large series of *S. boulengeri*. The coloration of the latter species is also very different, there being a distinct light line along each side of the back.

Sceloporus magister Hallowell.

Numerous specimens of this large lizard were obtained at Fort Lowell in May and June, 1893, and in May, 1894. It was not seen elsewhere.

Sceloporus consobrinus Baird & Girard.

Twenty-one small *Scelopori* from Fort Lowell, Fairbank, and Upper Rucker Cañon in the Chiricahua Mountains seem to belong to this species. I have not been able to compare them with specimens from near the type locality. All have two very distinct light lines along each side of the body. The dark dorsal area usually shows small blotches of dark brown, but may be unicolor. Males have a blue patch on each side of the throat. Femoral pores vary from twelve to sixteen on each side.

Sceloporus scalaris Wiegmann.

Mr. Price's notes indicate that this is a rock-dwelling species, and that it occurs at great altitudes. The specimens collected furnish, I believe, the most northern record of its range. They are quite typical, and were collected near the summit of the Huachuca Mountains, May 22, 1894, in Morse's Cañon, April 7, 1894, and "at an altitude of 9500 feet" in the Huachuca Mountains, July 22, 1893.

Prof. Baird recorded this lizard from Los Nogales (Mex. Bound. Surv., p. 6).

Sceloporus jarrovii Cope.

Yarrow's Scaly Lizard was found to be common in certain parts of the Huachuca and Chiricahua Mountains where it was taken on the ground, on rocks and on logs. It was collected, also, at an altitude of 7500 feet, in Morse's Cañon near Fairbank, and several were secured in the vicinity of Fort Lowell.

Phrynosoma hernandesi (Girard).

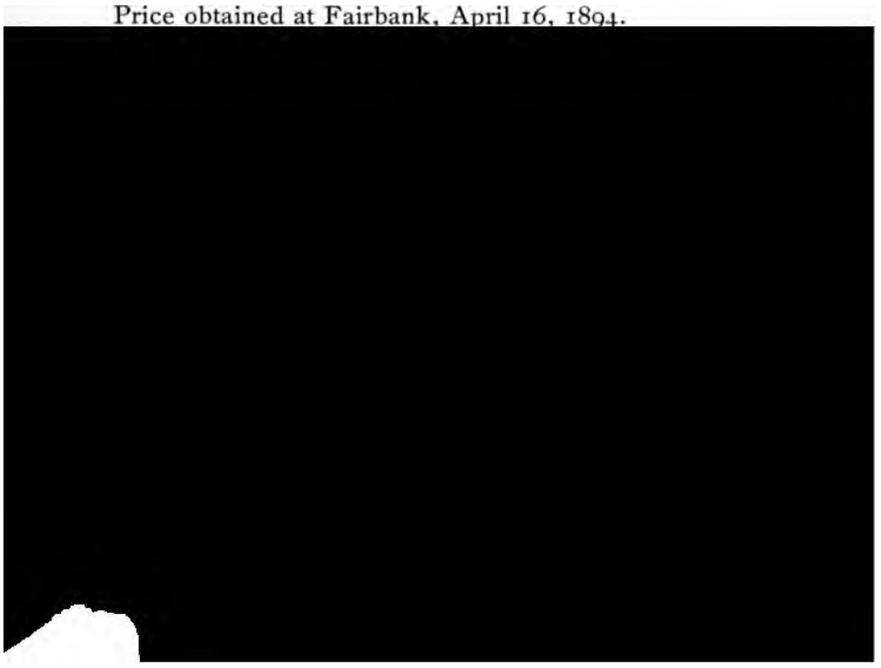
This species is represented in the present collection by two males and four females. Two of these secured in the Huachuca Mountains, August 25, 1893, do not differ appreciably from the other four caught at Fairbank, March 9 and May 13, 1894.

Phrynosoma solare Gray.

Five typical examples of this horned toad were taken on the desert near Fort Lowell, May 28 to June 24, 1893, and April 14, 1894.

Phrynosoma cornutum (Harlan).

There appears to be no difference between Texan specimens of this species and an individual which Mr. Price obtained at Fairbank, April 16, 1894.



contact with first supralabial plate. Thirty-one of these have only two large anals, while forty-eight have three arranged in the usual triangular form—one in front of two.

In *C. gularis* the whitish longitudinal lines which originate at the parietal plates are much closer together than in *C. sexlineatus*, the distance between them being rather less than that between any other two of the longitudinal lines in *C. gularis*, while it is nearly twice this distance in *C. sexlineatus*. The light vertebral band or pair of lines seen in *C. sexlineatus* is normally absent from *C. gularis*, but one young specimen shows a faint, narrow median line.

Young specimens have six longitudinal lines on a dark brown ground without light spots. The two of these lines nearest to the middle of the back are usually slightly narrower and less distinct than the others. In older specimens the ground-color becomes a little lighter in places, presenting a faintly mottled appearance. In still larger specimens small whitish spots appear between the lines (first on the posterior part of the back), and in the largest individuals these become more numerous and sometimes join the longitudinal lines. The latter, however, never lose their distinctness, although they become somewhat broader with age. Different individuals of the same size show much variation in the extent to which these markings have been developed, but their presence is clearly due to increased age, and not to either sex or season.

These lizards were collected near Fort Lowell and in Rucker Cañon.

Cnemidophorus scalaris (Cope).

Two specimens agree very well with the description and figures given by Prof. Cope (Trans. Am. Philos. Soc., xvii, pt. 1). They are much larger than *C. gularis*,

and are possibly, though improbably, very old males of that species. It seems best for the present to consider them distinct, and, since the two forms were found together, one cannot be regarded as a subspecies of the other. One specimen (2936) is labeled "Arizona," the other (2141) was shot near Fort Lowell.

Cnemidophorus tigris melanostethus (Cope).

I have been unable to detect any difference between *Cnemidophori* from southeastern Arizona and specimens of *C. tigris* from Idaho and California, except that adults from the former locality have throats suffused with intense black, while in *C. tigris* this region is usually grayish slate. The types of *C. melanostethus* are more nearly like *C. tigris* than like the specimens from southeastern Arizona, but their paleness may be seasonal rather than geographical. When more specimens have been collected it may become necessary to regard *melanostethus* as a synonym of *tigris*, and perhaps to supply a new name for the form found in southeastern Arizona.

A large number of specimens was obtained near Fort Lowell, in Rucker Cañon, and in the Huachuca Moun-

No. 2631, Fairbank, Cochise County, Arizona, W. W. Price, May 13, 1894.

Description of the Type.— Nostril anterior to nasal suture; three parietals; four supraoculars; seven superciliaries; two frontoparietals; scales on middle of eyelid enlarged; nasal in contact with second upper labial, the postnasal and first upper labial being separated; posterior gular scales small, abruptly smaller than the anterior, the line of demarkation between them being emphasized by the two rows nearest the latter being slightly smaller than the rest of the posterior ones; plates of collar rather large, in several rows, the marginal largest; dorsal granules smooth, rather large; ventral plates in eight longitudinal and thirty-one transverse rows; three large preanals, the posterior two widest; four rows of brachials, the posterior much the smallest; antebrachials continuous with brachials, in two rows, the outer a little the larger; granules along posterior edge of lower surface of forearm very slightly enlarged; lateral caudal scales oblique, rather strongly keeled, pointed posteriorly.

The color above is pale brown with three longitudinal bluish white lines on each side, and one equally distinct, narrow and well-defined line along the middle of the back. The limbs are a little paler than the ground-color of the back, and are without traces of markings except a faint light line along the back of the thigh. Under parts whitish, tinged with blue. Tail unicolor, grayish.

The measurements are almost exactly those of the type specimen of *C. labialis*. Total length 181 mm.; snout to collar 18 mm.; width of head 8 mm.; snout to interparietal 10 mm.; snout to forelimb 19.5 mm.; collar to vent 37 mm.; forelimb 19.5 mm; hindlimb 39.3 mm.; vent to end of tail 126 mm.

This lizard need be compared only with *Cnemidophorus*

labialis Stejneger, from Cerros Island, Lower California. To facilitate comparison I have used the wording of the original description of that species so far as the differences in my specimen will permit. The distinguishing characters of the two forms may be tabulated as follows:

C. labialis.	*C. arizonæ.*
Two large preanals.	Three large preanals.
Frontal very narrow behind.	Frontal not unusually narrow behind.
Gular and collar scales smaller.	Gular and collar scales larger.
Postantebrachials not enlarged.	Postantebrachials slightly enlarged.
Limbs longitudinally striped.	Limbs unicolor.
Tail with distinct color bands.	Tail without distinct color bands.
A wider indefinite median dorsal band.	A narrow well-defined median dorsal line.

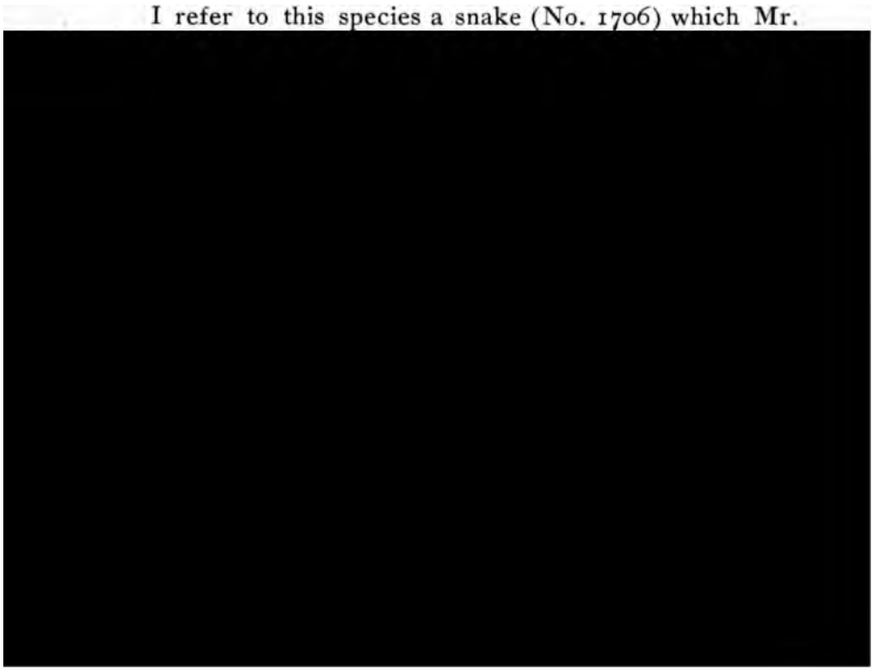
I am greatly indebted to Dr. Leonhard Stejneger of the U. S. National Museum for the privilege of examining one of the original specimens of *C. labialis*.

Eumeces obsoletus Baird & Girard.

One specimen of this skink was found at Fort Grant, Graham County, by Mr. H. Boutelle.

Tantilla coronata Baird & Girard.

I refer to this species a snake (No. 1706) which Mr.



Lampropeltis splendida (Baird & Girard).

Two specimens of this handsome snake were taken, one of which was "shot in a tree in river-bottom near Fort Lowell, May 28, 1893."

Lampropeltis pyrrhomelas (Cope).

Mr. Price found this species only in the Huachuca Mountains in July and August, 1893.

Salvadora grahamiæ Baird & Girard.

Three typical specimens were taken in Upper Rucker Cañon, April 1, 1894, at Fairbank, August 20, 1893, and in Rucker Cañon, April 29, 1894.

Diadophis regalis Baird & Girard.

This *Diadophis* was noted only at Fort Lowell, where a single specimen was secured May 8, 1894. It is 740 mm. in total length, and has 66 urosteges.

Bascanion flagellum frenatum Stejneger.

The only specimen of this form is labeled merely Arizona.

Bascanion piceum Cope.

One specimen, with coloration typical of *B. piceum* but with only seventeen rows of scales, was "shot in the brush near the river at Fort Lowell, May 28, 1893." This is the third Arizonan example of this doubtful species, the other two being the type from Camp Grant and one which Dr. Stejneger has recorded* from Tucson.

Bascanion semilineatum Cope.

A single snake of this species was caught in the Huachuca Mountains, June 30, 1894.

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*N. A. Fauna, No. 7, 1893, p. 209.

Pituophis sayi (Schl.).

Gopher Snakes were found only at Fort Lowell. They were evidently quite common, for Mr. Price preserved more specimens of this than of any other snake. All were secured in May and June, 1893.

Crotalus molossus Baird & Girard.

A single typical specimen is represented in the collection by a head, neck and tail. It was taken at Fort Lowell in June, 1893.

Crotalus atrox Baird & Girard.

The head and posterior portion of an adult *C. atrox* (1712), collected at Fort Lowell, May 25, 1893, are pinkish buff. Number 1708 is a young specimen, also from Fort Lowell, and, like most Arizonan examples of this rattlesnake, is much paler than those from the San Lucas Fauna of Lower California.

Crotalus lepidus Kenn.

There seems to be a general clearing of the ground-color with age in this species. Two adult specimens (No. 3139 and Cal. Acad. Sci. No. 179) have very few scales between the large dorsal blotches tipped with dark brown

but united above. In the fourth example they are united above on one side of the head but distinct on the other.

These specimens are from near Fort Lowell and the Huachuca Mountains.

Crotalus pricei Van D. Plate L.

Proc. Cal. Acad. Sci. (2), v, 1895, p. 856.

This species seems to be most closely related to *Crotalus intermedius* Fisch. and *C. omiltemanus* Günth., but may be readily recognized by its very distinct coloration. From *C. omiltemanus* it differs also in its smaller number of gastrosteges; and from *C. intermedius*, in its fewer urosteges.

Of five specimens in the collection three are from the Huachuca Mountains; the others are without exact localities, but Mr. Price informs me that they also were collected in the Huachucas.

DESCRIPTION OF A NEW LIZARD (EUMECES GILBERTI) FROM THE SIERRA NEVADA OF CALIFORNIA.

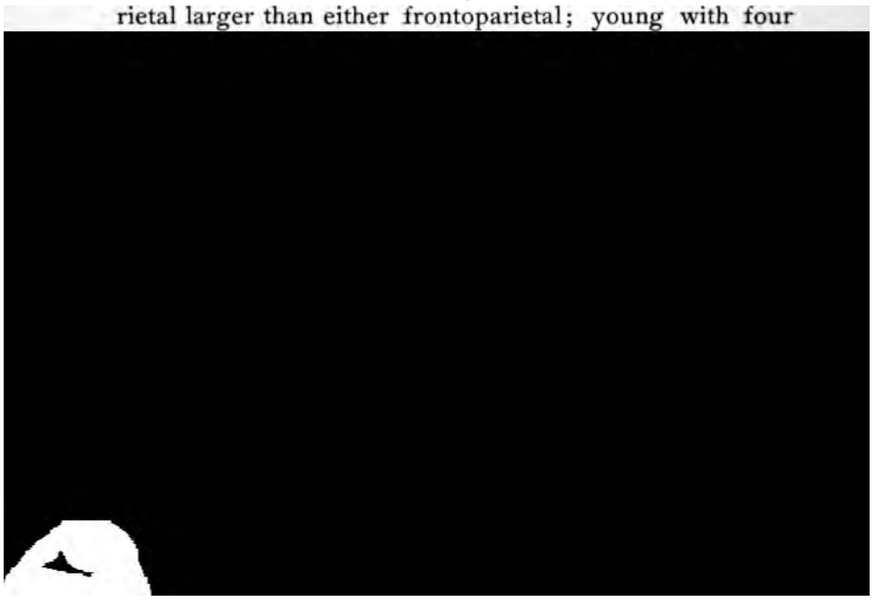
BY JOHN VAN DENBURGH,

Curator of the Department of Herpetology.

In an interesting collection of reptiles made by Dr. Charles H. Gilbert and Mr. James M. Hyde in and near the Yosemite Valley is a very distinct new skink of the genus Eumeces. This species is most closely related to *E. skiltonianus*, from which it seems scarcely to differ in scale characters, but exhibits a very different coloration. In *E. skiltonianus* the light lines are persistent, the upper pair are separated by two and two half longitudinal rows of scales, and the head is never red. The lizard which I propose to name in honor of Dr. Charles H. Gilbert grows to a much larger size than is ever attained by Skilton's Skink.

Eumeces gilberti, new species.

Diagnosis.—Twenty-four or twenty-six rows of scales around the middle of the body; postnasal present, in contact with first supralabial; two azygos sublabials (postmentals); subcaudals greatly enlarged; interparietal larger than either frontoparietal; young with four



nasal, postnasal, first labial, and rostral plates; postnasal touching nasal, internasal, anterior loreal, and first and second labials; anterior loreal forming sutures with postnasal, internasal, frontonasal, prefrontal, posterior loreal, and second and third labials; posterior loreal the larger; two preoculars; four large supraoculars; interparietal larger than either frontoparietal, narrower than is usual in *E. skiltonianus;* parietals very large, sometimes in contact behind, followed by one or two pairs of occipitals; temporals very large; upper labials eight, the last largest; symphysial very broad, followed by two broad azygos sublabials; several paired sublabials in contact with the infralabials; scales everywhere smooth, strongly imbricate except on head; median subcaudals very wide; upper caudals about the size of the dorsals, larger than the laterals, ventrals and gulars; twenty-four or twenty-six rows of scales around the middle of body; ear-opening about the size of an abdominal scale, feebly denticulate.

Adult brownish olive-buff above, slightly bronzed or faintly washed with red, without traces of longitudinal lines; dorsal scales edged with darker brown, often showing central spots of verdigris green; tail greenish or grayish yellow; limbs like back, without darker markings; head and more or less of neck bright poppy red slightly tinged with carmine, brightest near ear-opening, sometimes tinged with olive on top of head; lower surfaces, except of head, dull yellowish white.

Young with head and back dark seal brown, lighter on the centers of the scales, with four longitudinal light lines; lower line on each side indistinct except between ear and fore limb; upper pair of light lines broader than in *E. skiltonianus*, separated by only two rows of scales; limbs olive, darkest on the margins of the scales; tail bluish

gray with bronze and greenish tints near base; lower surfaces creamy white, grayish on belly.

Length to anus	52	64	81	81*	82	84	96
Length of tail	66	119	142	136	106†		158†
Snout to ear	10	12	15	15	16	15	19
Snout to occipital plates	9	11	13	13	14	14	16
Fore limb	12	17	20	21	21	20	25
Hind limb	18	24	29	30	32	30	34
Base of fifth to end of fourth toe	7	10	11	11	12	11	13

Habitat.—Western slope of the Sierra Nevada in the vicinity of the Yosemite Valley, California. Exact localities: Yosemite Valley, June 10–15; Inspiration Point, Yosemite Valley, June 10; four miles from Wawona, on Yosemite road at an altitude of about 4,500 feet, June 8, 1896.

Habits.—Very active; often in grass and fallen leaves, retreating to holes under stones and boulders.

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* Type.

† Tip reproduced.

CALIFORNIA WATER BIRDS. No. III.* — SOUTH FARALLON ISLAND IN JULY.

BY LEVERETT M. LOOMIS,
Curator of the Department of Ornithology.

[With Plates li and lii.]

During the afternoon of July 7, 1896, I left San Francisco for South Farallon Island in the gasoline schooner that made weekly visits to the island for the eggs gathered by the lighthouse keepers and their helpers. The outward trip was lengthened into the second day, for the schooner had business that required her to pass the night at Bolinas, some twelve miles up the coast. Happily the bank of fog that usually rests over the ocean at this season of the year was half a dozen or more miles out from the heads, leaving an open way along the mountainous shore, which stood out in bold relief against the eastern sky with Tamalpais in the background.

Between Point Bonita and Bolinas not many birds were seen, but within the Golden Gate Western and Heermann's Gulls were numerous. There were also a few California Murres.

In the morning, after waiting several hours for high water on the Bolinas bar, the schooner was headed toward the Farallones, and soon entered the bank of fog, which shut out sky, land, and sea, limiting our vision to a small circumference of water. About ten miles offshore 'Gonies' began to be plentiful. Often several were near the schooner at one time. So far as ascertained, all were Black-footed Albatrosses—none the young of the Short-tailed Albatross or the dark phase of the Giant

* 'No. I,' Proc. Cal. Acad. Sci., 2d ser., vol. v, June 19, 1895, pp. 177–224.

'No. II,' ibid., vol. vi, Feb. 21, 1896, pp. 1–30.

Fulmar, which species Dr. Cooper has reported from Monterey Bay during the palmy days of the whale fisheries (Am. Nat., iv, p. 758). A few Dark-bodied Shearwaters and Ashy Petrels were also noted. As the island was neared the Albatrosses became less numerous, finally giving place to wedge-shaped flocks of Murres returning to their rookeries—their course apparently so well determined that the fog was no obstacle.

Guided by the compass, we had almost reached the island before we caught the first glimpse of it through a rift in the fog. Half an hour later the schooner was anchored in Fisherman's Bay. The cries of the Murres on the mist-hidden cliffs, the scent of guano that pervaded the air, and the busy activity of the eggers about the little wharf, gave a momentary impression that our port was a center of population and trade, and not a mere bird-rock in the Pacific Ocean.

The field-notes that follow were taken during the brief interval between the 8th and 16th of July, my stay on the island terminating with the last trip of the schooner for the season.

I. INDIGENOUS BIRDS.

Lunda cirrhata. TUFTED PUFFIN.—'Sea Parrots' were

bird will simply leave its egg and retreat as far as the recess in the rock will allow. When pulled out of their retreats with a wire, they are eager to fight, seizing whatever is placed within reach of their formidable bills, and holding on to it tenaciously. The lighthouse people and the eggers had much to say of the vicious spirit the 'Sea Parrots' sometimes display toward one another. Two that were fighting, I was told, rolled down a declivity for more than one hundred feet without relinquishing their bull-dog grip. An encounter is said to end always in the death of one of the combatants. So far as I observed, the 'Sea Parrots' were peaceable among themselves and toward other birds. That their conflicts are so sanguinary perhaps tends to make them infrequent. When sitting about on the rocks they are also quite fearless. A group of five was photographed within less than ten feet of the camera—the birds remaining quiet but watchful spectators while the tripod was being adjusted on the uneven rocks.

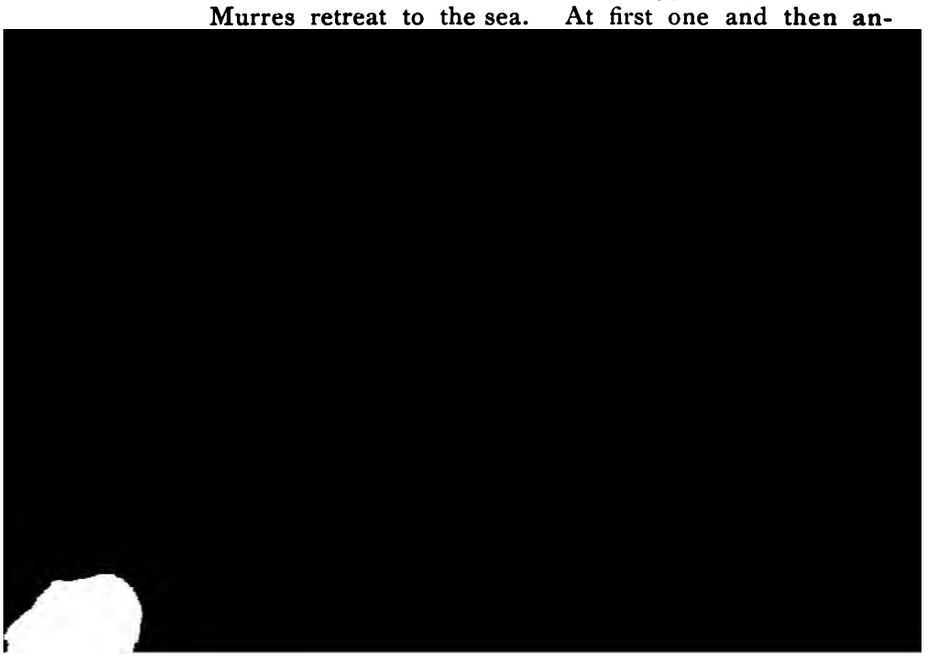
Ptychoramphus aleuticus. CASSIN'S AUKLET.—In searching for Petrels among the piles of stone, Cassin's Auklets were brought to light. They offered no great resistance when taken into the hand, and when tossed into the air usually fell helplessly to the ground, apparently too dazed to fly. Both eggs and young birds were found—the former chiefly in an advanced stage of incubation. Some of the young, partially fledged, were nearly as large as adults. In one instance an Auklet was discovered sharing its apartment with two rabbits.

The afternoon of the 13th was warm and cloudless, and just after sundown several large flocks of these Auklets were seen flying about high in air over the island, recalling to mind Chimney Swifts on a summer's day in the East. At two o'clock the following morning I was

awakened and informed that the bird population was in uproar. It was pitch dark, but the whole island seemed to be alive with birds. Their voices, suggestive of those of Whip-poor-wills, filled the air. I was told this nocturnal concert was given by Cassin's Auklets. From this incident some real conception was formed of the abundance of this species upon the island.

Cepphus columba. PIGEON GUILLEMOT.—The sibilant notes of 'Sea Pigeons' greeted the ear all through the day on the eastern part of the island, where they were very common sitting about on the rocks. West End was apparently not congenial to them, for none were noticed there. Unlike the Tufted Puffins, they were very timid when brooding, taking flight whenever the crevices containing the eggs were approached closely. A set of fresh eggs was found the first day near the wharf in Fisherman's Bay. The laying season, however, appeared to be practically over before my visit.

Uria troile californica. CALIFORNIA MURRE.—The more inaccessible cliffs and the outlying islets fairly swarmed with Murres. When the eggers approach the Murres retreat to the sea. At first one and then an-



on the floor at the back part of the cave, and when pressed may be readily caught as they flounder towards the entrance. Some of these finally succeed in getting awing, others become swamped at the mouth of the cave by the inrushing waves and are forced to dive to avoid being carried upon the rocks.

The eggers go over the rookeries systematically, the outlying rocks and different portions of the main island being visited on successive days, fresh eggs being thus assured. Only one small isolated rock is reserved as a breeding place, and upon this the Murres were so crowded that a bird coming in from fishing could not alight without disturbing the footing of others. There were many situations on the main island where scarcely any were seen. In some of these places, I learn from Mr. W. Otto Emerson, a large population flourished within the last decade.

From Mr. W. A. Beeman, principal keeper of the Farallon light-station, I ascertained that seven thousand six hundred and forty-five dozen eggs were shipped to San Francisco the present year.* At the last the price dropped to twelve and a half cents a dozen. In 1884, Mr. Emerson informs me, as many as three hundred thousand eggs were gathered. The market became glutted, one cargo being dumped into San Francisco Bay and another abandoned on the island. In those days the

* The number for each week of the season, ending July 16, is as follows:—

First week	120	dozen.
Second "	1445	"
Third "	2080	"
Fourth "	1400	"
Fifth "	2000	"
Sixth "	600	"
Total	7645	dozen.

eggs in transportation were piled in the holds of the egg-boats, now they are put into small wooden boxes. According to the late Dr. W. O. Ayres, a founder of the Academy ('Water Birds of North America,' vol. ii, p. 485), more than five hundred thousand eggs were sold in less than two months in 1854—all collected in one limited portion of South Farallon Island, and "in the opinion of the eggers, not more than one egg in six of those deposited on that island was gathered." Dr. Heermann, writing early in the fifties of the Murres on the Farallones, says, "The traffic in their eggs from this place to San Francisco and inland reaches the value annually of between one and two hundred thousand dollars"—P. R. R. Rep., vol. x, pt. iv, No. 2, p. 75.

In past years, it appears, the birds of the North Farallones have not been systematically harassed. This year, however, rivals to the South Farallon light-keepers were located there, a schooner taking the eggs off weekly if a landing could be effected. The crop was said to be larger than that of South Farallon.

It is apparent that unless this devastation is put an end to the Farallon Murre rookeries will ere long belong to the past. A state law prohibiting the sale of eggs of wild

whenever they have the opportunity. When the eggers appear on the scene the Gulls congregate and soon a large flock is formed, circling about overhead with loud cries, eagerly awaiting the flight of the Murres to join in the pillage.

When exceptionally hungry the Gulls are said to suddenly descend in a compact flock among the Murres, frightening them from the eggs. One Gull was seen trying to steal an egg from under a Murre. The Murre gave a reproachful squawk and with a thrust of the bill drove the Gull away. This was the only show of spirit I witnessed among these inoffensive birds—helpless upon land, but rare divers and swimmers at sea.

A few well-incubated eggs of the Western Gull and a few downy young were found at the West End. Whenever the eggers came across either they promptly destroyed them, the traffic in Murres' eggs tending not only to the extinction of the Murres, but of the Western Gulls as rivals in the business. That the work of destruction has been effectual is manifested by the fact that only Gulls in the complete attire of adults were seen, those in immature plumage being wholly wanting. At the opening of the season, the Gulls in turn supply the demand of the markets, but the harvest of their eggs is not now great. No other Gull was observed near the island. Heermann's Gull, however, was numerous about San Francisco Bay.

Oceanodroma leucorhoa. LEACH'S PETREL.*—As the collection of the Academy did not contain a single Ashy Petrel, one of the chief objects of the trip to the type lo-

*The Farallon specimens as well as four others at hand from St. Lazaria Island, Sitka Bay, Alaska, have some white at the base of the outer rectrices. Whether this character is peculiar to the birds of the North Pacific I am unable to determine until comparison is made with Atlantic Ocean examples.

cality of the species was to obtain a series of specimens. To facilitate the work of collecting, the services of all the children on the island were enlisted "to smell for Petrels." The first one discovered had white upper tail-coverts. This was indeed a surprise. South Farallon having been visited so many times by ornithologists, it was not supposed there still remained a species to be added to the list of its breeding birds.* The specimen was found in a pile of large stones extending for several rods around the base of the light-tower hill, east of the keepers' dwellings. In the course of an hour three other individuals were secured—all from one end of the pile. The other end appeared to be tenanted exclusively by Ashy Petrels. On succeeding days two more were discovered in the same situation. One of these, as its habitation was being uncovered, escaped through an unobserved outlet, rising readily on wing and disappearing in the direction of the ocean. This was the only individual of either species that sought security in flight. A seventh example was picked up dead at the foot of the lighthouse tower. Search in other parts of the island revealed only Ashy Petrels. However, one of the eggers told me that the majority of the parents of the thirty eggs he collected

recently from the shell, each of the specimens I obtained was brooding upon an egg. But one of the eggs was sufficiently fresh to be easily blown. Judging from the specimens examined, they are of greater size than those of the Ashy Petrel. As is likewise the case in this latter species, the markings are not always present on the larger end, the egg sometimes being immaculate white. Two of the birds dissected were males, showing that the duties of incubation are shared by both sexes.

The Petrel with a 'white rump' seen by Dr. Cooper near San Nicholas Island in July, 1863, and recorded in the first series of the 'Proceedings' (vol. iv, p. 11) as perhaps being *Oceanites oceanicus* may have belonged to the present species.

Oceanodroma homochroa. ASHY PETREL.—Although these Petrels were breeding abundantly in all parts of the island, every portion of it might have been passed over in daylight without a single individual being discovered, for apparently only brooding birds occurred, concealed in loose piles of stone, in stone walls, and under drift-wood. After nightfall the Petrels became active. They were especially conspicuous during the early morning hours of the 14th when the Auklets held their concert. As I stood in the dooryard of a keeper's house, every few moments one or more would pass silently by, disappearing in the darkness. Their flight recalled that of a Goatsucker.

The strong musky odor of the Petrels renders their discovery in the rock piles easy. It is only necessary to insert the nose into likely crevices to find them. With little practice one may become very expert in this kind of hunting, readily determining whether it is an Auklet or a Petrel that has its residence in any particular cranny. Sometimes the Petrels are within reach, but usually the rocks have to be removed to get at them. When uncov-

ered they generally shrink away as far as they can, but occasionally one will remain on its egg. When tossed into the air they fly without difficulty. Eggs with well-developed embryos were the rule, but there were also fresh eggs and downy young in various stages of growth. In seventeen specimens preserved, the organs of reproduction, except in one female, displayed marked degeneration, showing that the breeding season was about over. Apparently nearly as many males as females were brooding. With a single exception, all the examples taken, including a partial albino, were very fat. It seemed strange to find these birds of the ocean rearing their young near the dwellings and within several rods of the siren. None of the feathered inhabitants of the island appeared to be alarmed at the blasts of this signal, repeated every forty-five seconds when the fog settled down.

As there are no rats or snakes on the island the Petrels seemingly have no constant enemies to contend against during their sojourn except the eggers and the light-keepers' children who collect the eggs of the Petrels and sell them to collectors. One collector, I was told, gave a standing order for all they could furnish to him. As

are said to suffer greatly. On the 15th I landed on Sugar-Loaf (a Murre islet) to examine a rookery of Brandt's Cormorants. The birds deserted their nests as soon as I came near them. Not more than two eggs were in a nest; in some cases only one. All appeared to have been recently deposited. July 2, 1894, at Monterey, chiefly young birds were found. See 'No. I,' p. 220.

II. NON-INDIGENOUS BIRDS.

RED PHALAROPE *(Crymophilus fulicarius)*.—A mummy in spring plumage was picked up near the surf on the eastern part of the island, a short distance from the keepers' houses.

WANDERING TATLER *(Heteractitis incanus)*.—One was seen on the rocks at the surf on the 13th.

HUDSONIAN CURLEW *(Numenius hudsonicus)*.—An individual was observed the last morning of my stay near the spot where the Red Phalarope was found. Both of these species are additions to the Bryant-Emerson list.

BLACK TURNSTONE *(Arenaria melanocephala)*.—Stragglers were noted from the outset along the rocky shore.

If the Farallon Rail *(Porzana coturniculus)* was obtained on South Farallon, its occurrence is purely fortuitous, like that of the Black-throated Blue Warbler and other estrays. There is not a square foot of the island that would afford suitable habitation for a swamp-loving species. If a Gätke was stationed on South Farallon the list of wanderers would probably rival that of Heligoland.

III. BIBLIOGRAPHY.

In the following catalogue are given the titles of the special articles upon the Farallones I have incidentally met with in my reading.

In this connection should be mentioned the observations of Dr. Heermann, published with other notes on California birds in vol. x, pt. iv, No. 2 of the Pacific Railroad Reports, and of Dr. Cooper in the 'Water Birds of North America.' The former writer includes several transient species in the avifauna of the islands overlooked by recent observers.

1856. [HUTCHINGS, J. M.] The Farallone Islands. *Hutchings' California Magazine*, vol. i, Aug., 1856, pp. 49–57, illust. 10.

A description of a trip to South Farallon Island, in which the birds come in for a due share of consideration.

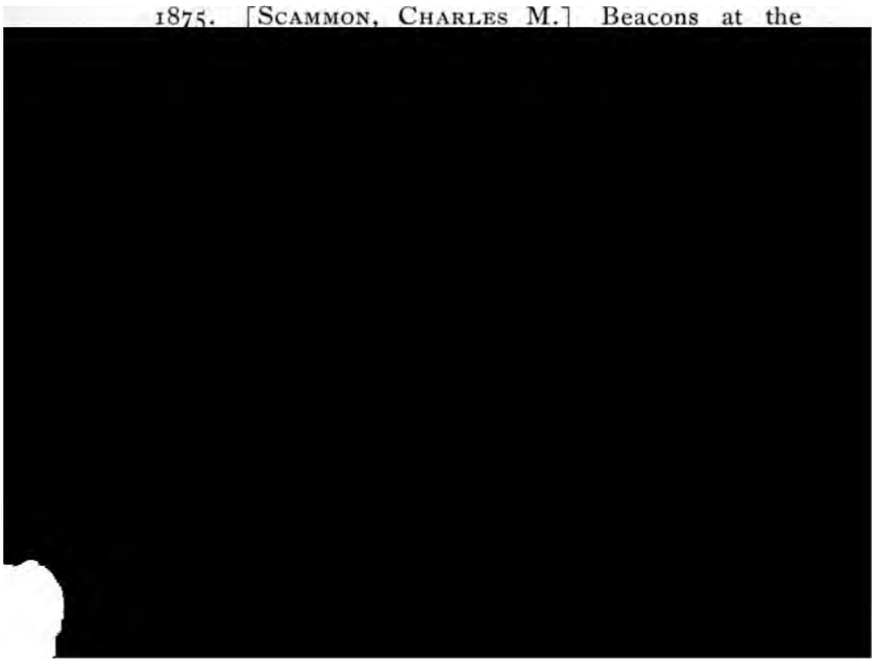
1862. GRUBER, F. Die Farallones-Inseln und deren Naturprodukte. *California Chronik*, 13. Juli 1862, 20. Juli 1862, 27. Juli 1862.

"Enthalten ornithologische Notizen." Not seen. Title from Coues in 'Bibliographical Appendix' of 'Birds of the Colorado Valley.'

1874. NORDHOFF, CHARLES. The Farallon Islands. *Harper's New Monthly Magazine*, vol. xlviii, April, 1874, pp. 617–625, illust. 8.

Popular account of South Farallon, including its feathered inhabitants.

1875. [SCAMMON, CHARLES M.] Beacons at the



vol. i, Jan. 19, 1888, pp. 25–50, pl. 1='Map of Farallon Island.'

An annotated list of eighty-one species based upon the observations of W. Otto Emerson, conducted on South Farallon between June 14 and July 2, 1885, and May 2 and June 2, 1887, supplemented by information supplied by Mrs. W. H. Rugg, wife of the chief light-keeper.

It is hoped that Mr. Emerson will revisit the scene of his former investigations and report the changes that have transpired.

1892. BLANKINSHIP *and* KEELER. On the Natural History of the Farallon Islands. Geology and Botany by J. W. Blankinship. Zoology by Charles A. Keeler. *Zoe*, vol. iii, July, 1892, pp. 144–165 ('Birds,' pp. 154–165), pll. xviii–xxi.

This paper is an account of a two-days' reconnaissance of South Farallon during the first week of July, 1892. *Porzana carolina* is given as an addition to the local ornis.

1892. GREENE, CHARLES S. Los Farallones de los Frayles. *The Overland Monthly*, vol. xx, 2d ser., Sept., 1892, pp. 226–246, illust. 14.

The story of a brief visit in June, 1892, is the central feature of this article, treating, in a popular vein, of the topography, geology, history, and biology of South Farallon.

1893. TAYLOR, H. R. A Trip to the Farallones. *The Nidiologist*, vol. i, Oct., 1893, pp. 17–20, illust. 5.

Briefly narrates the experiences of an ornithological excursion to South Farallon.

1894. BARLOW, C. Nesting of the Ashy Petrel. *The Nidiologist*, vol. i, Aug., 1894, pp. 171–173, illust. 3.

An interesting chapter in the life history of this species.

1894. BARLOW, C. Some Notes on the Western Gull. *The Nidiologist*, vol. ii, Sept., 1894, p. 7, illust. 1.

Pertains to its piratical proclivities and its nesting habits.

1895. TAYLOR, H. R. The Farallons in 1856. *The Nidiologist*, vol. ii, Jan., 1895, pp. 59, 60–62, 63, illust. 3.

Chiefly quotations from the article of J. M. Hutchings (l. c.).

1895. BARLOW, C. Stray Notes from the Farallons. *The Nidiologist*, vol. ii, Aug., 1895, pp. 166, 167, illust. 1.

Comments upon the nesting of a pair of Ravens and upon the occurrence of Black Turnstones and of a single example of the Arkansas Kingbird and of the Black-throated Gray Warbler—the last not recorded in the Bryant-Emerson list.

NOTE.—To Capt. A. F. Rodgers of the U. S. Coast and Geodetic Survey (Western Division) I am indebted for the measurements relating to South Farallon Island, and also for the privilege of copying the maps that are the basis of those illustrating the present paper.

COLEOPTERA OF BAJA CALIFORNIA.

(SUPPLEMENT II.)

BY GEORGE H. HORN.

The following list contains those which have not been enumerated in my preceding contributions.

The species here recorded were sent me a year ago, and under ordinary conditions should have been published long since, but the species belonging to the Œdemeridæ have caused considerable trouble, and the investigation of these has revealed many things needing correction in the position of several species. This has compelled me to make a review of the entire family in which will be found the new species of the present series.

The new species other than the above are but few in number, and to that series I have, by the kind permission of the Academy, added such other descriptions and studies as have occurred to me during the progress of this paper.

Carabidæ.

Schizogenius depressus Lec. Arizona.. San José del Cabo, San Estaban, Baja California.

Thalpius rufulus Lec. Southern California. San José del Cabo.

Lebia callizona Bates. Mexico, Guatemala. San José del Cabo.

Dytiscidæ.

Copelatus fragilis Sharp. Mexico, Guatemala. San José del Cabo.

NOTE.—The collections in Baja California were made by Gustav Eisen and Frank H. Vaslit. For localities mentioned refer to map of Baja California, Proc. Cal. Acad. Sci., 2d Ser., Vol. V.

Desmopachria granum Lec. The reference of this specimen to this name is slightly in doubt, owing to immaturity. Georgia, Florida. San José del Cabo.

Cælambus fraternus Lec. California. San José del Cabo.

Hydaticus bimarginatus Say. Florida, Texas. San José del Cabo.

Thermonectes margineguttatus Aubé. Mexico, West Indies. San José del Cabo.

Hydrophilidæ.

Berosus mœrens Sharp. Mexico, Guatemala. San José del Cabo.

Helochares maculicollis Muls. Florida to Texas. San José del Cabo.

Staphylinidæ.

Tachyporas jocosus Say. Atlantic region to Texas. San José del Cabo.

Homalota sp. San José del Cabo.

Trogophlœus sp. Probably three species, which should

Corylophidæ.

Sacium hemipterum n. sp. San José del Cabo.

Endomychidæ.

Epipocus unicolor Horn. Arizona. San José del Cabo.

Cucujidæ.

Læmophlœus sp. Partly immature. San José del Cabo.

Silvanus rectus Lec. Texas, Arizona. Sierra San Lazaro, San José del Cabo.

Monotomidæ.

Monotoma picipes Hbst. Atlantic region, Texas, British Columbia, California. San José del Cabo.

Throscidæ.

Throscus chevrolati Bonv. Pennsylvania to Utah and Texas. San José del Cabo.

Histeridæ.

Epierus regularis Beauv. Florida, Texas, Arizona, California. San José del Cabo.

Saprinus alienus Lec. San Diego, California. Comondu, Baja California.

Buprestidæ.

Pœcilonota cyanipes Say. Canada, Colorado, New Mexico. San José del Cabo.

Lampyridæ.

Mastinocerus sp. Allied to *texanus*, and may not differ, but the condition of the specimen will not warrant an assertion. San José del Cabo.

Ptinidæ.

Petalium brunneum n. sp. San José del Cabo.

Hemiptychus pusillus Lec. Arizona, California. San José del Cabo.

Lyctus californicus Casey. California, Arizona. Sierra San Lazaro, Baja California.

Scarabæidæ.

Atænius inops Horn. Texas, Arizona. San José del Cabo.

Atænius cognatus Lec. Florida, Texas, Arizona. San José del Cabo.

Rhyssemus riparius Horn. Arizona. San José del Cabo.

Chrysomelidæ.

Œdionychis gibbitarsis Say. Middle States to Texas. San José del Cabo.

Coptocycla clavata Fab. Atlantic region, Texas. San José del Cabo.

Bruchidæ

Meloidæ.

Cantharis melæna Lec. Boundary of Arizona and Sonora, Mexico, Santa Margarita Island. San José de Gracias, Baja California.

Negalius marmoratus Casey. Western Texas. San José del Cabo.

Mordellidæ.

Mordellistema ambusta Lec. Pennsylvania, Nevada, Texas. San José del Cabo, San Lazaro.

Œdemeridæ.

Some changes have been made in the generic position of many of the species in this family and the reader is referred to the synopsis of the family which follows this contribution.

Alloxacis nitidula n. sp. San José del Cabo.

Oxacis granulata Lec. Cabo San Lucas. Was accidentally omitted in the previous contributions.

Oxacis fragilis n. sp. Utah, Arizona. San José del Cabo.

Oxacis dubiosa n. sp. San José del Cabo, San Lazaro.

Cossonidæ.

Cossonus sp. San José del Cabo.

Brenthidæ.

Vasseletia vasseleti Boh. In noticing this species in the "Biologia" Dr. Sharp seems in doubt as to the correctness of the locality given by Boheman. The species is peculiar in appearance and unlike those usual in the Mexican fauna.

Two specimens are now before me, a male from Sierra el Chinche, Baja California, and a female from Culiacan, Sinaloa, Mex.

Brenthus anchorago Fab. This name must be used in place of *B. lucanus* Horn.

Scolytidæ.

Coccotrypes (Dryocœtus) dactyliperda Fab. Atlantic region. San José del Cabo.

New Species and Other Studies.

In the following pages three only of the new species belong strictly to the present essay, by far the larger number having been placed where they properly belong in the "Revision of the Œdemeridæ" which follows.

Chlænius nimrod n. sp.

Bright green as in *sericeus*, shining on head and thorax, elytra opaque, the entire margin beyond the eight striæ and the apex more widely yellowish testaceous, epipleuræ pale. Antennæ pale. Head smooth, with a few coarse punctures above the eyes. Thorax slightly longer than

fine punctures. Legs pale. Length .48 ♂ –.54 inch.; 12–13.5 mm.

This species belongs to the series in which the male has a spinulose area on the anterior side of the middle tibiæ at apex, and by the narrow propleuræ is allied in our fauna to *herbaceus* and *ruficauda*. It is notable among our species in having the moderately wide pale margin to the elytra.

I have not been able to assign a satisfactory position to the species by the method suggested by Chaudoir (Annali Mus. Civ. Genova, 1876), the subdivisions based on the punctuation of the abdomen are purely artificial, and their limits inappreciable.

Two specimens from Custer, South Dakota, sent me by W. D. Hunter of the University of Nebraska. I have named the species in allusion to him.

Sacium hemipterum n. sp.

Broadly oval, scarcely a fourth longer than broad; color above yellowish testaceous, with nearly the basal half of the elytra piceous, surface shining, sparsely pubescent. Head piceous. Thorax very sparsely punctate, more than twice as wide at base as long, hind angles acute. Elytra more coarsely punctate than the thorax, punctures sparse, pubescence fine and yellow, color of basal half piceous black, the apical portion yellowish testaceous and translucent, the division between the colors sinuous. Body beneath, abdomen, and hind legs piceous, prothorax beneath and four front legs yellow. Length .04 inch.; 1 mm.

This species is more broadly oval than any known to me in our fauna, and is notably different in the coloration of the elytra.

One specimen. San José del Cabo.

Litolibrus pictus n. sp.

Broadly oval. Beneath piceo-testaceous. Head and thorax castaneous, elytra piceous with testaceous, translucent space at apex, and an intra-humeral red spot. Elytra with sutural stria extending three-fourths to base, the usual series of punctures extremely indistinct near the suture and entirely obliterated at the sides. Abdomen sparsely punctate and pubescent. Length .08 inch.; 2 mm.

San José del Cabo.

Phyllobænus merkeli n. sp.

Slender, parallel, piceous black, moderately shining, with sparsely placed erect hairs, and a silken white pubescence forming an indistinct design on the elytra, each elytron with a yellow spot on the margin behind the middle. Head coarsely, densely punctate. Thorax slightly wider than long, obtusely subangulate behind the middle, disc flattened at middle, surface densely and coarsely punctate. Elytra slightly wider posteriorly, disc flattened with a short smooth subcostiform elevation about the middle of the disc on each side, surface coarsely,

have securiform terminal joints. Spinola has described them very correctly (Clerites, pt. 2, p. 3), thus, "last joint of each of the same form and nearly the same size, slender, conical, and truncate." Lacordaire also states that the antennæ have eleven joints, but this has been properly corrected to ten by LeConte.

Petalium brunneum n. sp.

Elongate, brownish, opaque, sparsely clothed with short fulvous pubescence. Head coarsely and closely punctate. Thorax broader than long, narrowed in front, a slight sinuation each side in front of middle, disc convex, with an oblique impression each side in front, surface rather coarsely and closely punctate. Elytra with the two outer striæ entire, the sutural extending one-half from apex, the other striæ represented by rows of punctures which are coarse and subquadrate near the base, and become gradually finer and indistinct toward the apex, the intervals punctulate. Metapectus rather coarsely punctate. Abdomen finely and closely punctate. Length .06 inch.; 1.5 mm.

P. bistriatum Say., the only other species known, is larger, piceous, with extremely feeble elytral sculpture, and with the lateral and sutural striæ by no means as well impressed. San José del Cabo.

Cerotoma Chev.

Cerotoma furcata Oliv. Ent., vi, p. 643, pl. iii, fig. 50.

In a review of the species described by Olivier I stated that this could not be a synonym of *trifurcata*, as given in the "Catalogus." Later, in my synopsis of Galerucini (Trans. Am. Ent. Soc., xx, p. 129), I accepted this view. Recently specimens have been collected by Mr. E. A. Schwarz near Brownsville, Texas, agreeing per-

fectly with the description and figure of Olivier. It should, therefore, be restored to our list.

In a revision of Galerucini published by me (Trans. Am. Ent. Soc., xx) several years ago, several errors occurred, which I now desire to correct.

Phyllecthrus Lec.

Antennæ dissimilar in the sexes, thickened toward the tip ♂, filiform ♀, but 11-jointed in both sexes.
  Antennæ more or less yellow ♂; totally black ♀.
    Thorax decidedly broader than long; elytra sparsely punctulate. *parallelus.*
    Thorax nearly square; elytra vaguely subsulcate and rather coarsely punctured. *subsulcatus.*
  Antennæ black ♂; female unknown. *Schwarzi.*
Antennæ similar in the sexes, filiform and black; 10-jointed ♂, 11-jointed ♀.
    Small species (.10–.15 inch.), legs more yellow. *gentilis.*
    Large species (.18–.25 inch.), legs more black. *dorsalis.*

The change in the table is in the removal of *dorsalis* from the series in which the antennæ are dissimilarly formed in the sexes, but with an equal number of joints, to the series in which the antennæ are similar in form, but with unlike number of joints.

PHYLLECTHRUS GENTILIS Lec. Nothing remains to be added to this species. My remarks concerning *atriventris* Say., under this heading, should be obliterated.

Phyllecthrus schwarzi n. sp.

Form of *dorsalis*, which it closely resembles. Black, shining. Head and thorax yellow, the latter broader than long, piceous at the sides. Elytra black, with a narrow yellow border at posterior half of the suture, surface sparsely obsoletely punctate. Legs black, knees yellow. Length .20 inch.; 5 mm.

Male. Antennæ but little longer than half the body, eleven-jointed, black, slightly compressed, and broader toward the tip; joints 2–3 small, equal, together shorter than the fourth. Middle tibiæ deeply notched on the inner side near the apex. First joint of anterior tarsus shorter than second. Second ventral segment with an obtusely conical process at middle near the posterior edge; third ventral transverely excavated along the posterior edge each side of middle.

This is the male described by me as that of *dorsalis*. The discovery of the true male of that species enables me to correct my mistake, and as a slight evidence of my appreciation of his watchfulness the species is dedicated to E. A. Schwarz.

The emargination of the middle tibiæ in this species and *dorsalis* is similar to that seen in the front tibiæ of Carabidæ. The same character is well marked also in *subsulcatus* and *parallelus*, but faint in *gentilis*.

One specimen. Texas.

Phyllobrotica Redt.

The table given by me (Trans. Am. Ent. Soc., 1893, p. 98), should be thus modified:—

Asida flaccida n. sp.

Slender, elongate, dark, castaneous, feebly shining, surface with sparse, short, fulvous hairs, elytra with short, scattered, erect black setæ. Head very coarsely and roughly punctured, neck more finely and densely. Thorax slightly wider than long, apex deeply emarginate, sides rather strongly arcuate, very slightly sinuate posteriorly, base feebly bisinuate, hind angles rectangular, disc flat at middle, the sides widely reflexed, surface coarsely punctate at the sides. Elytra scarcely wider than the thorax and about three times as long, disc rather flat, rapidly declivous posteriorly, the side margin acute, not widely reflexed, terminating at the declivity in a lobelike process, surface sparsely and indistinctly punctate, a fulvous hair or short spine arising from each puncture; deflexed sides of elytra sparsely spiculose. Body beneath sparsely punctate and with very short erect spinules. Prosternum concave between the coxæ. Legs slender, clothed with short hairs, the outer apical angle of front tibiæ slightly prolonged. Length .54 inch.; 13.5 mm.

It is barely possible that this species may be the male of *embaphionides* (Proc. Cal. Acad. Sci., 1894, p. 419, pl. vii, fig. 8), which it resembles in many of the minor details. It is, however, more slender, the sides of the elytra more reflexed, and the margin developed into a lobelike process at the declivity.

One specimen. San José del Cabo.

Negalius marmoratus Casey.

The unexpected occurrence of this insect in the peninsula enables me to speak definitely concerning it.

I have already expressed the opinion that there are no real differences between Negalius and Calospasta (Proc. Cal. Acad. Sci., 1894. p. 438). The mandibles are, however, much stouter, the free edge grooved, the apices four-toothed on the left side and five on the right. The mandibles of Calospasta have but one groove, as in the case in Tegrodera. In Eupompha the mandibles more nearly approach those of Negalius, being quite strongly toothed.

N. marmoratus resembles at first sight an old and weathered specimen of *Epicauta pardalis*.

Cephaloon Newm.

The occurrence of two new species makes it necessary to amplify the table published by LeConte (Proc. Bost. Soc. Nat. Hist., xvi. p. 276):

Appendage of claws broad.
  Appendage rounded at tip.
    Antennæ very evidently thicker externally, scarcely longer than the head and thorax. *lepturides.*
    Antennæ slender, scarcely thicker externally, evidently longer than head and thorax.
      Color entirely piceous. *piceum.*
      Color in great part yellow; antennæ with three basal joints yellow, the outer gradually paler. *tenuicorne.*

In the male the last ventral segment is acutely emarginate.

Two specimens have been seen. One is entirely piceous, including the antennæ. A second has the three basal joints of the antennæ paler, the abdomen in great part, and the femora entirely yellow.

Cariboo District of British Columbia. From Mr. Chas. Fuchs.

Cephaloon bicolor n. sp.

Form slender, elytra, metasternum, and spots at sides of abdomen piceous, surface densely, finely punctured, clothed with very short and fine pubescence. Antennæ slender, longer than the head and thorax, piceous, the three basal and three outer paler. Last joint of maxillary palpus triangular, apical side arcuate. Length .42–.48 inch.; 10.5–12 mm.

The male has the last segment triangularly notched.

Two specimens have been seen. The male is entirely yellow beneath, the female has the metasternum and oval spots at the sides of segments 2–3–4 spiceous.

Sonoma and Placer Counties. From Mr. Chas. Fuchs.

THE ŒDEMERIDÆ OF BOREAL AMERICA.

BY GEORGE H. HORN.

It is now over forty years since Dr. LeConte published (Proc. Acad. Phil., vii) a short review of the species then known to him. In the meantime the number has been greatly increased, and a great number are at present in my cabinet without name.

In a recent volume of the "Biologia" (vol. iv, pt. 2), Mr. G. C. Champion reviewed the species of Central America, and incidentally indicates the erroneous generic status of some of our species.

Among the species placed in my hands for study by the California Academy of Sciences, collected in Baja California, were many specimens, nearly all of which seem to have been aggregated under the name *lucana*. A close study of all the material in their possession showed plainly that three species have been included under this name in most collections.

Further study showed that among our well known eastern forms two species of distinct genera had been passing as *thoracica*.

mixed; this, together with the necessity for the correction of errors noticed by Mr. Champion and myself, and the presence of a fair number of new species needing description, has suggested the propriety of presenting a new study of all our species, that they might properly be compared with each other.

The study of Oxacis was particularly interesting. As constituted by LeConte, it was to contain species with simple mandibles, simple claws, two tibial spurs, and eleven-jointed antennæ. LeConte, however, included one species in which the right mandible was not simple, but with a tooth on the upper side.

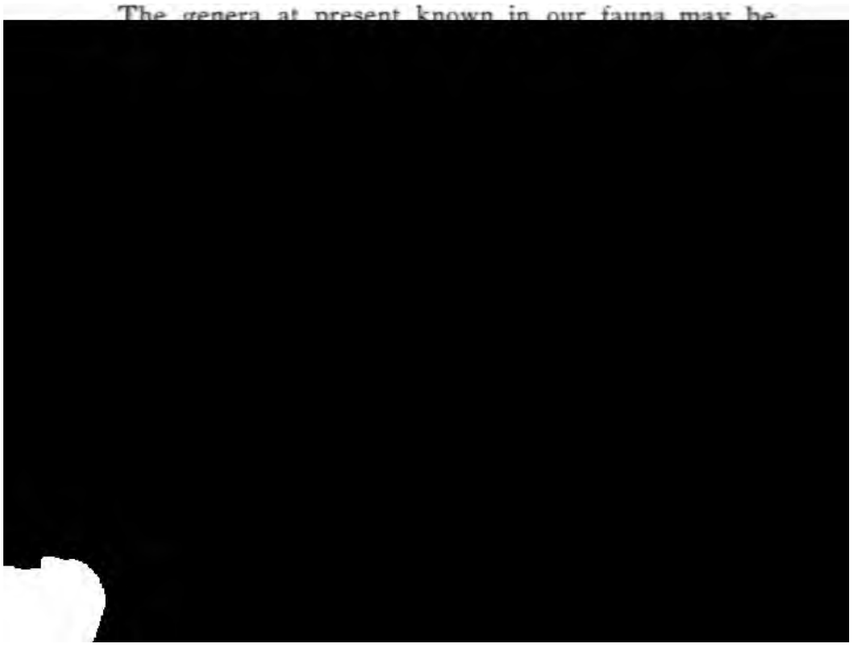
On the other hand those species with a toothed claw were separated as Probosca, which Mr. Champion has shown to be incorrect, and my observations have confirmed. Mr. Champion also finds that species must be admitted in Oxacis with both toothed and simple claws. Our species do not exhibit intergrades but the Mexican forms do. At this point it might be observed that the only valid difference between Copidita and Asclera is that the first has simple claws and the latter toothed. I cannot, however, consent to admit that *dorsalis* and its allies can be included in Oxacis. The so called toothed right mandible of that species is really a bifid mandible in which the upper tooth is a little shorter to permit proper articulation with the absolutely simple left mandible. This structure seems to me exactly intermediate between those species with both mandibles bifid and both simple, and to include such a structure with both simple and toothed claws in one genus is not only unnatural and confusing, but also suggests the thought that all three genera should be united. The better course has seemed to be to separate these heterogeneous forms as a distinct genus.

The genus Probosca accordingly disappears from our lists. On the other hand I have found it necessary to add two other European genera: Sparedrus and Chrysanthia, the former to include *Calopus aspersus* and probably many if not all those described from Mexico by Mr. Champion, the latter a new species which so closely resembles *thoracica* as to be not easily separated from it.

The genus Microtonus has also given rise to the suggestion of Mr. Champion that it should probably be referred to the Melandryidæ. While I agree with him that the genus seems here out of place, a discussion of the question would involve the validity of several entire families. The Melandryidæ, Pythidæ (including Mycterus, etc.) and Œdemeridæ are by no means well defined, as I some years ago intimated in a brief study of the first of these families.

For the present it will be better, as Mr. Champion suggests, to allow Microtonus to remain in the position in which it was placed by LeConte, until such time as the species referred to it by Champion, as well as some Symphora (to which it seems allied), can be more closely studied.

The genera at present known in our fauna may be



Tarsi with the penultimate alone spongy-pubescent.	5.
5.—Both mandibles bifid at tip.	6.
Right mandible bifid, left entire.	*Alloxacis.*
Both mandibles simple.	9.
6.—Head slightly prolonged, the antennæ at base separated from the eyes.	8.
Head short, antennæ very near the eyes.	7.
7.—Claws simple.	*Copidita.*
Claws toothed.	*Asclera.*
8.—Eyes entire; antennæ slender.	*Chrysanthia.*
Eyes slightly emarginate, antennæ slightly flattened.	*Sisenes.*
9.—Head short.	*Oxacis.*
Head prolonged in a beak.	*Rhinoplatia.*

Calopus Fab.

Form slender. Eyes deeply emarginate, embracing the base of the antennæ. Mandibles bifid at apex. Antennæ subserrate, inserted upon slight protuberances, eleven-jointed. Tibiæ with two terminal spurs, tarsi with two joints spongy-pubescent beneath, the penultimate alone bilobed, the antepenultimate triangular and but feebly emarginate. Claws simple.

This genus is represented by one species in our fauna, which resembles in its habitus some of our more slender Elaphidion.

Calopus angustus Lec. Ann. Lyc. N. Y., v, p. 158.

Form slender, brownish, finely, sparsely pubescent. Head moderately coarsely punctate, more densely between the eyes than posteriorly. Thorax as wide as long, sides moderately arcuate in front, then parallel to base, disc moderately coarsely and closely punctate, surface uneven. Elytra more than half wider at base than the thorax, nearly parallel, vaguely subcostulate, surface coarsely and moderately closely punctate. Body beneath much more finely punctate than above, rather sparsely on the metasternum, more densely on the abdomen. Length .50–.72 inch.; 12.5–18 mm.

In the male the fifth ventral segment is broadly and deeply emarginate and the eyes closer on the vertex. In the female the fifth ventral is obtuse at apex.

Occurs in Texas, New Mexico, Canada (Quebec), Nevada, California, Oregon, and Washington.

Sparedrus Schmidt.

Form slender. Eyes deeply emarginate. Mandibles simple at apex. Antennæ slender, scarcely at all subserrate, eleven-jointed, three-fourths the length of the body. Tibiæ with two terminal spurs. Tarsi with two joints spongy-pubescent beneath, the two penultimate joints bilobed. Claws simple.

In this genus I place one species described by Dr. LeConte as Calopus, from which it is removed by reason of the form of the mandibles and tarsi. From any literature at my disposal I am unable to find any characters by means of which the species may be separated from Sparedrus, and it seems preferable to place it as such rather than suggest a new name to which I can assign no differential characters.

Some Mexican species described by Mr. Champion (Biologia iv, pt. 2) as Calopus seem far more closely re-

than the thorax, but less closely and with denuded slightly elevated spots more numerous near the apex. Body beneath moderately closely punctate, sparsely pubescent. Length .30–.48 inch.; 7.5–12 mm.

The male has the fifth ventral broadly but not deeply emarginate.

Specimens have been collected in Texas and at Cabo San Lucas, Baja California. It will probably be found in Arizona also.

Microtonus Lec.

Form slender. Head short, frontal suture distinctly impressed. Eyes rather coarsely granulate, slightly emarginate by a canthus under which the antennæ are inserted. Antennæ slender, eleven-jointed. Maxillary palpi with the terminal joint cultriform but not long. Anterior tibiæ with two small spurs. Middle coxæ distinctly separated. Tarsi slender, the penultimate joint scarcely dilated but distinctly lobed beneath. Claws simple.

I have already adverted to the doubt as to the position this genus should occupy in our system. Mr. Champion has suggested Melandryidæ with very probable correctness. There will be observed an important character which seems to have escaped notice. The antennæ in all Œdemeridæ known to me are inserted with a naked base. In Microtonus they are inserted under a canthus as is quite commonly seen in Melandryidæ.

One species only is known in our fauna although six others have been described, mostly from Guatemala.

Microtonus sericans Lec. New Species, 1862, p. 259.

Slender, brownish, feebly shining, sparsely clothed with short yellowish hairs with silken lustre. Head coarsely and moderately closely punctate. Thorax trans-

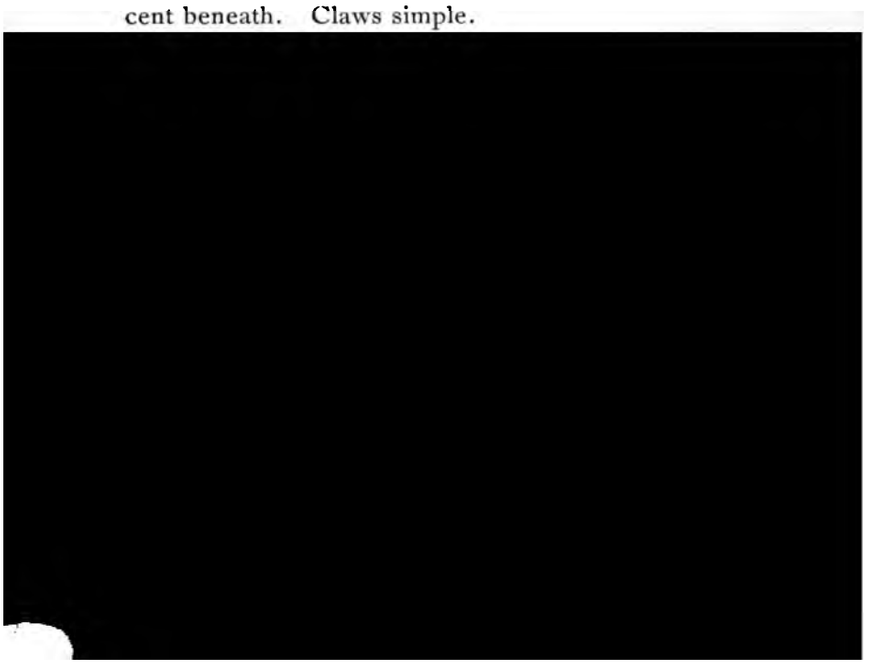
versely quadrate, slightly narrower in front, sides feebly arcuate anteriorly and behind, the middle very slightly sinuate, the hind angles acute; disc moderately convex, a vague depression each side, surface closely punctate. Elytra but little wider at base than the thorax, a vague depression on each behind the base, surface closely and coarsely punctate, without traces of costæ. Body beneath more shining than above, metasternum densely and coarsely punctate, the abdomen more finely and not densely punctate. Length .15–.20 inch.; 3.75–5 mm.

No sexual differences have been observed.

Occurs in the entire eastern Atlantic region.

Ditylus Fischer.

Body stout. Antennæ eleven-jointed, two-thirds the length of the body, the second joint longer than half the third. Head not large, eyes finely granulated and very feebly emarginate, the antennæ inserted at a slight distance from them. Last joint of maxillary palpi triangular, the free edge arcuate. Anterior tibiæ with two terminal spurs. Tarsi with at least two joints spongy-pubescent beneath. Claws simple.



Thorax distinctly longer than wide, not densely punctured, almost devoid of pubescence. *gracilis.*

Thorax fully as wide as long.

Thorax not densely punctured, scarcely pubescent, very distinctly narrower posteriorly. *cæruleus.*

Thorax very densely punctured, pubescent, scarcely narrower posteriorly. *quadricollis.*

Ditylus gracilis Lec. Proc. Phil. Acad., vii, p. 18.

Form rather more slender than the other species, black, head and thorax submetallic violaceous. Head moderately coarsely punctate, the punctures distinctly separated. Thorax distinctly longer than wide, sides moderately arcuate in front, gradually narrower posteriorly, disc feebly depressed at middle posteriorly, pubescence short and inconspicuous, surface submetallic, shining, the punctuation not coarse and well separated. Elytra densely punctulate, opaque, with fine and short pubescence, disc finely quadri-costulate. Body beneath slightly violaceous, very densely punctulate except on the metapectus. Length .60–.80 inch.; 15–20 mm.

This species is easily known by its usually slenderer form, narrower and not densely punctate thorax.

Occurs in Oregon and Washington.

Ditylus cæruleus Rand, *(Upis)* Bost. Journ. ii, p. 20.

Form robust, black, with faint violaceous tinge more evident on the head and thorax. Head moderately coarsely, not closely punctate. Thorax broader than long, widest one-third from apex, thence obliquely narrowed to base, which is narrower than the apex, disc somewhat irregular, a shallow triangular expansion in front, surface moderately coarsely, not densely punctate, slightly shining, with a V-shaped region less punctate. Elytra densely punctate and opaque, with extremely short pubescence, disc quadri-costulate. Body beneath slight-

come invalid by the discovery of other species. The generic name will, however, be retained until some one with greater opportunities and more material shall have studied the family more carefully than it is possible for me to do at the present time.

The species known to me are as follows:—

Elytra piceous with the suture and entire limb testaceous.
  Head testaceous with indefinite piceous spaces; thorax pale with median piceous stripe and lateral spots; femora piceous. *trinotata.*
  Head entirely yellow; thorax yellow with lateral spots only; femora yellowish. *lateralis.*
Elytra pale testaceous with, at times, a slight humeral cloud.
  Head and thorax yellowish, the latter with a slight lateral spot often absent. *testacea.*
Elytra uniform in color.
  Elytra distinctly blue; thorax reddish yellow.
    Head yellow; legs parti-colored. *californica.*
    Head black; legs totally black. *marina.*
  Elytra piceous black, rarely slightly purplish; thorax reddish yellow with central spot.
    Head black; legs black. *centralis.*

Xanthochroa trinotata Lec. New Species, 1866, p. 164.

Form slender and elongate, brownish, sparsely, finely pubescent, elytra with suture and entire border pale. Head punctate, sparsely on the front, color pale yellow

Xanthochroa lateralis Mels. *(Nacerdes)* Proc. Phil. Acad., 1846, p. 54.

Xanthochroa signaticollis Had. Journ. Phil. Acad., 2d Ser. i, p. 96.

Form slender, elongate, black, suture and margin of elytra yellow, head and thorax in great part yellow. Antennæ black. Head yellowish, often piceous behind the eyes, surface shining, sparsely punctate. Thorax scarcely longer than wide, sides in front arcuate, posteriorly sinuate, and somewhat dilated at base, color yellow, with a piceous black space each side, surface sparsely and indistinctly punctate, shining. Elytra densely punctate and opaque, disc subcostulate, the third costa from suture very feeble. Body beneath piceous, finely punctulate, last segment of female yellow. Legs yellow, the tibiæ in part and the tarsi piceous. Length .28–.40 inch.; 7–10 mm.

The fifth ventral of the male is elongate, slightly broader at apex, elevated along the middle, deeply triangularly emarginate. In the female the last ventral has a small triangular emargination at apex, the surface slightly concave, color yellow.

Occurs in the southern Atlantic region.

Xanthochroa testacea n. sp.

Form slender, elongate, parallel, color above entirely yellowish testaceous, a slight piceous area each side of the thorax, another at the humeri extending in a variable degree to the apex; metapectus and abdomen piceous. Head sparsely, indistinctly punctate, shining. Thorax as wide as long, sides arcuate in front, sinuately narrowing posteriorly, surface shining, very sparsely punctate. Elytra densely punctate, vaguely quadri-costulate, finely pubescent. Body beneath piceous, the abdomen very sparsely punctate. Legs pale. Length .36–.42 inch.; 9–10.5 mm.

In the male the last ventral segment is deeply and acutely triangularly emarginate and of yellow color. In the female the segment is sharper than at apex and very convex, the edge turned upward and entirely piceous.

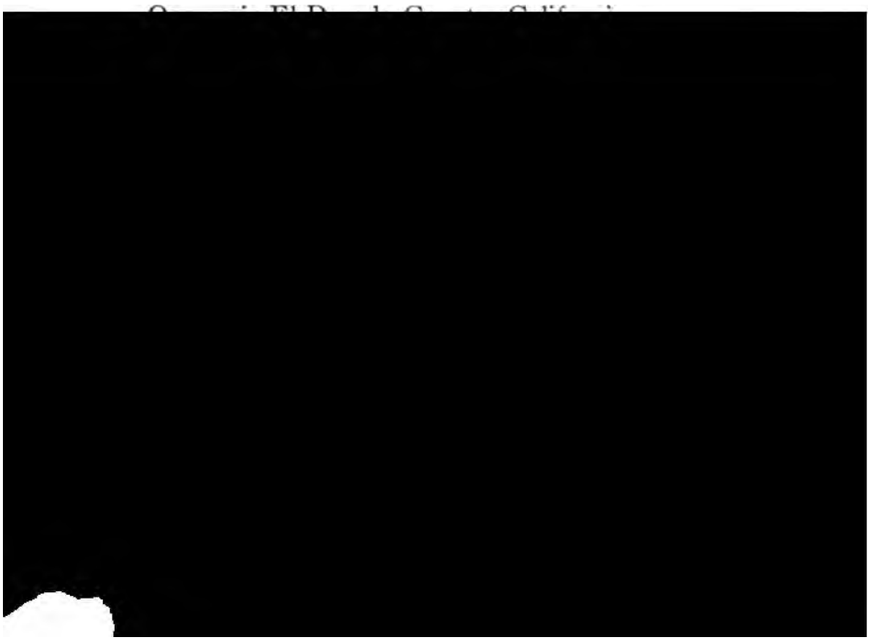
The specimens examined show very little variation.

Numerous specimens from Washington and Vancouver.

Xanthochroa californica Horn, Trans. Am. Ent. Soc., 1874, p. 39.

Form slender, elongate, head, thorax and legs (in great part) reddish yellow, elytra decidedly blue, beneath piceous. Antennæ piceous, the first two joints paler beneath. Head sparsely punctate. Thorax as wide as long, sides arcuate in front, sinuate posteriorly, slightly expanded at base, surface shining, very sparsely punctate. Elytra densely punctate, subopaque, decidedly blue in color, sparsely pubescent, disc feebly subcostulate. Body beneath piceous with faint bluish tinge. Legs in great part pale, tibiæ and tarsi piceous. Length .24–.38 inch.; 6–9.5 mm.

The male characters are very like those of *lateralis*. In the female the fifth ventral is elongate-oval, subacute at apex and entire.



The male has the last ventral segment deeply triangularly incised and the sexual apparatus has the spoon-shaped claspers usual in the genus.

One specimen. Marin County, California.

Xanthochroa centralis n. sp.

Form slender and elongate, piceous; thorax reddish yellow with a small piceous spot at middle. Antennæ black. Head piceous, front yellow, very sparsely punctate. Thorax as wide as long, sides arcuate in front, then oblique, at base slightly expanded, disc smooth, very sparsely punctate, a slight concavity which is piceous. Elytra densely punctate, subopaque, distinctly subcostulate, sparsely pubescent. Body beneath piceous, shining, sparsely punctate. Legs entirely piceous. Length .28–.36 inch.; 7–9 mm.

In the male the fifth ventral is in great part pale, deeply and densely triangularly emarginate. In the female the segment is also in great part yellow, obliquely prolonged and acute at tip, elevated along the middle and deeply concave each side.

In a large number of specimens seen very little variation has been noticed. Rarely the central piceous spot of the thorax is absent, and almost as rarely specimens occur with a small additional black spot each side.

Sylvania, California. (Ricksecker.)

Alloxacis n. g.

Form slender. Head oval, not prolonged. Eyes very feebly or not at all emarginate. Antennæ slender, eleven-jointed in both sexes, in contact with the eyes at base (except in *dorsalis*). Last joint of maxillary palpi triangular, widest at middle. Mandibles dissimilar, that of the left side simple and acute at tip, that of the right side bifid, with the upper tooth shorter. Tibiæ with two

terminal spurs. Penultimate joint of tarsi alone spongy-pubescent beneath, the claws toothed.

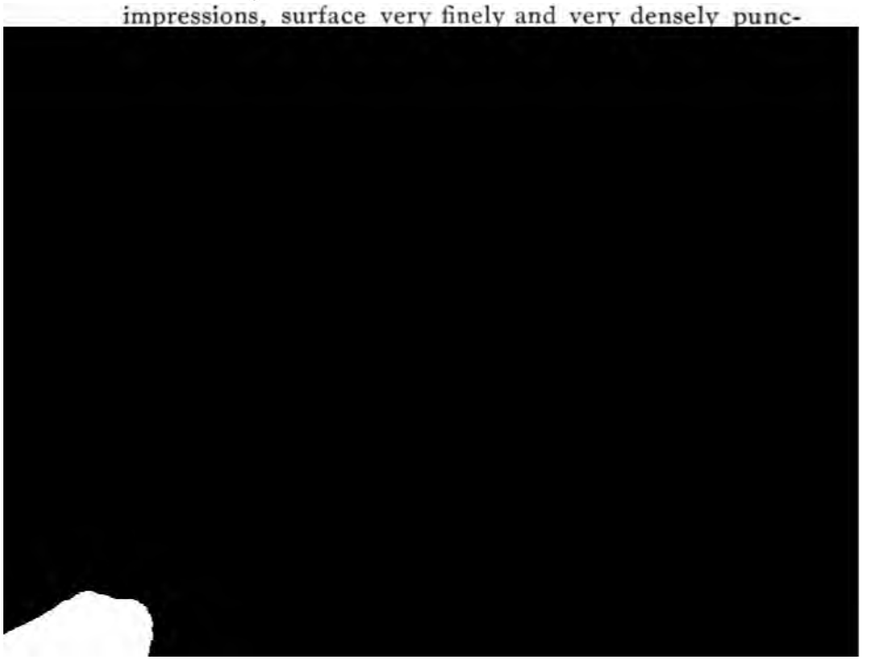
The only difference between this genus and Oxacis is in the form of the mandibles. The character is constant, without variation and with no evidence of intermediate forms. One of the Mexican forms recently described by Mr. Champion in Oxacis seem to have similarly formed mandibles *(holosericea)*, and should be placed here.

The species known to me are as follows:—

Claws quadrangularly dilated at base; elytra pale testaceous with fuscous vittæ.	***dorsalis.***
Claws sharply toothed.	
Pale testaceous; elytra vittate.	***pleuralis.***
Brownish testaceous; elytra not vittate.	***floridana.***
Entirely piceous.	***nitidula.***

Alloxacis dorsalis Mels. *(Nacerdes.)* Proc. Phil. Acad., 1846, p. 55.

Pale testaceous, thorax with a central, and elytra with two variable fuscous vittæ; surface finely pubescent. Head sometimes with a fuscous cloud, finely and densely punctured. Thorax as wide as long, sides feebly arcuate at front angles, then oblique to base, disc with three faint impressions, surface very finely and very densely punc-



Pale yellowish testaceous; thorax fuscous at sides; elytra with a submarginal fuscous vitta and often a shorter scutellar one. Head closely and finely punctate. Thorax slightly longer than wide, sides feebly arcuate in front, oblique posteriorly, disc regular, surface densely, finely punctate, smoother on the median line. Elytra finely and closely punctate, without trace of costæ. Body beneath pale, abdomen very finely punctate, the last two segments coarsely. Legs pale. Length .30–.40 inch.; 7.5–10 mm.

The last joint of the maxillary palpus is cultriform and the tarsal claws acutely toothed. Specimens occur with a fuscous abdomen. These have the submarginal vitta broader, and in addition a short scutellar vitta. The knees and tips of tibiæ may be fuscous also in these latter forms.

Occurs in Florida and Texas.

Alloxacis floridana n. sp.

Pale brownish testaceous, finely pubescent. Head finely not coarsely punctate. Last joint of maxillary palpus cultriform. Thorax not longer than wide, sides anteriorly arcuate, thence oblique to base, disc regularly convex, finely and densely punctured. Elytra more coarsely and less densely punctured than the thorax, with faint traces of costæ Body beneath finely but not very densely punctate. Claws acutely toothed. Length .28 inch.; 7 mm.

Resembles *pleuralis* in many ways, but has a broader thorax, and is entirely uniform in color.

One specimen. Biscayne Bay, Florida. (Schwarz.)

Alloxacis nitidula n. sp.

Slender, piceous, very finely cinereo-pubescent, antennæ and legs pale. Head paler in front, finely, closely punctate. Thorax longer than wide, sides feebly arcuate

in front, slightly oblique posteriorly, disc regularly convex, closely punctulate. Elytra finely, closely punctulate, without trace of costæ. Body beneath entirely piceous, rather more coarsely punctate than above. Legs pale, femora often fuscous. Claws acutely toothed near the base. Length .26 inch.; 6.5 mm.

This insect so closely resembles some of the dark forms of *lucana* and *dubiosa* that it requires an examination of the mandibles to separate them. It equally resembles also some of the dark forms of *tæniata*.

The last joint of the maxillary palpus is rather triangular, being wider at middle.

Cabo San Lucas, Sierra San Lazaro, and San José del Cabo. Baja California.

Copidita Lec.

Form slender. Penultimate joint of tarsi bilobed and alone spongy-pubescent beneath. Anterior tibiæ with two terminal spurs. Tarsal claws simple. Mandibles bifid at tip. Last joint of maxillary palpi cultriform or triangular. Antennæ slender, eleven-jointed, the terminal joint in the male sinuate above.

Copidita was originally formed to contain but one

This is, however, an error of observation, which, had it been true, would ally Copidita more closely with Ditylus.

Copidita as above constituted will contain the following species: —

Last joint of maxillary palpus cultriform; widest near base. 2.
Last joint of maxillary palpus triangular; widest near apex. 3.
2.—Antennæ fusco-testaceous.
Elytra pale or fusco-testaceous. *quadrimaculata.*
Antennæ black.
Elytra unicolored; legs black.
Thorax red with basal black spots. *notoxoides.*
Thorax reddish, immaculate. *thoracica.*
Elytra with suture and margin pale.
Thorax piceous at sides; head more or less pale. *suturalis.*
Thorax reddish yellow, paler at apex and base; head black. *mimetica.*
3.—Thorax decidedly broader than long; elytra nearly black without metallic lustre. *obscura.*
Thorax not wider than long; elytra blue.
Thorax reddish. *bicolor.*
Thorax black. *cyanipennis.*
Entire body and legs fusco-testaceous. *fuliginosa.*

In the above list all the species excepting the last three have the antennæ inserted close to the eyes.

Copidita quadrimaculata Motsch. *(Probosca)* Etudes, 1852, p. 78; *(Nacerdes)* Bull. Mosc. 1853, p. 267; Lec. New Species, p. 166.

Elongate, brownish, testaceous. Antennæ pale. Head yellowish, the occiput more or less piceous, surface punctate. Thorax longer than wide, sides arcuate in front, sinuate posteriorly, base slightly explanate; surface densely punctate with a fine smooth median line, color reddish yellow with three piceous spots in a transverse row, another near the base. Elytra finely and densely punctate, finely pubescent, indistinctly subcostulate. Body beneath in great part piceous. Legs pale, the knees piceous. Length .52–.66 inch.; 13–16.5 mm.

In the male the fifth ventral is deeply sinuate each side, the middle produced in an obtuse lobe. The penis has two hooks on tip and on each side are two elongate spoonlike pieces. The last dorsal is elongate-oval, subacute, and deeply concave. In the female the last ventral is more elongate, the sides oblique near the apex.

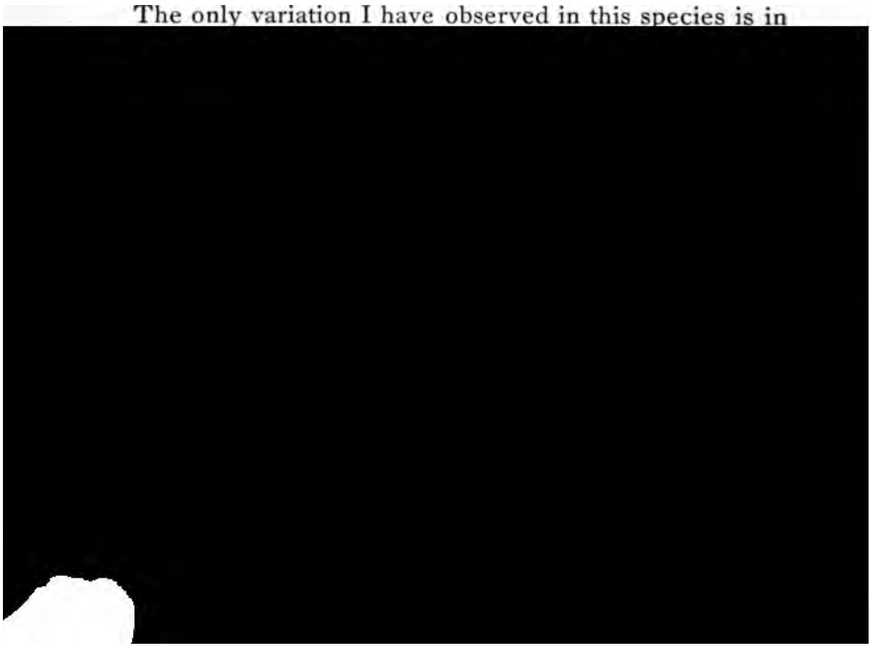
Very little variation has been observed. Sometimes the central thoracic spot is elongate, and the lateral spots may be absent.

Occurs abundantly on the sea coast near San Francisco and southward.

Copidita notoxoides Fab. *(Necydalis)* Syst. El., 2, p. 369.

Form slender, in great part black, thorax and tibiæ reddish yellow. Antennæ black. Head black, densely punctured. Thorax slightly longer than wide, sides arcuate in front, sinuate posteriorly, coarsely and closely punctate, alutaceous, color reddish yellow, with a black spot each side at base. Elytra black, finely pubescent, densely punctate, subopaque, surface obsoletely costulate. Length .24–.36 inch.; 6–9 mm.

The only variation I have observed in this species is in



black. Head black, closely punctate. Thorax longer than wide, sides arcuate in front, sinuate posteriorly, disc slightly depressed each side, surface moderately coarsely not densely punctate and alutaceous. Elytra moderately coarsely and closely punctate, finely pubescent, faintly subcostulate. Body beneath finely punctulate. Legs black. Length .20–.28 inch.; 5–7 mm.

In some specimens an indistinct piceous spot occurs in the thorax, others again have pale tibiæ.

Occurs from the middle States to Florida and Texas.

Copidita suturalis n. sp.

Form slightly robust. Antennæ piceous. Head yellow, coarsely punctate. Thorax scarcely longer than wide, sides arcuate in front, sinuately narrowing posteriorly, disc coarsely and closely punctate, color variable, normally yellow at middle, broadly piceous each side. Elytra moderately densely and coarsely punctate, distinctly subcostulate, color piceous, with the suture and side margin pale to a variable degree. Body beneath either entirely piceous or with the middle pale and sides piceous. Legs pale, tarsi and knees darker. Length .26–.40 inch.; 6.5–10 mm.

This insect resembles closely specimens which have been received from Europe, as *Dryops vittata* Fab., but in the present species the surface is more coarsely punctate and the mandibles are bifid. Some specimens so closely resemble *Oxacis vittata* that it is necessary to examine the mandibles to separate them. No sexual differences have been observed.

Occurs abundantly in Georgia and Florida, and specimens have been taken in southern New Jersey by Mr. Wenzel.

Copidita mimetica n. sp

Form slender, piceous black. Thorax reddish yellow, paler at apex and base. Elytra with the suture and entire margin pale. Antennæ black. Head black, moderately coarsely punctate. Thorax longer than wide, sides arcuate in front, sinuately narrowing posteriorly, disc somewhat irregular, surface somewhat coarsely and closely punctate and alutaceous, color reddish yellow, decidedly paler at apex and base. Elytra piceous black, opaque, moderately coarsely, densely punctate, finely subcostulate, slightly pubescent. Body beneath and legs piceous, finely punctate. Length .36 inch.; 9 mm.

The majority of specimens examined have piceous legs, but many occur with pale legs, the knees and tarsi above darker.

This species bears so close a resemblance to *Oxacis cana* that the specimens have been associated with that species in every collection examined.

Specimens are known to me from Kansas and Texas.

Copidita obscura Lec. (*Asclera*) Proc. Phil. Acad., 1854, p. 21.

bordered with yellow, and either entire or with a feeble notch.

Slightly more robust in form than any other of the genus. It was described as Ditylus, but as the penultimate joint of the tarsus is spongy beneath, it has been removed to the present genus.

Occurs in Colorado and New Mexico.

Copidita fuliginosa Lec. (*Oxacis*) New Species, p. 166.

Form slender, piceo-testaceous or brown, moderately shining, finely cinereo-pubescent. Head and thorax finely punctate. Thorax longer than wide, sides arcuate in front, narrower posteriorly, apical and basal margins paler. Elytra not densely punctulate. Length .34 inch.; 8.5 mm.

In the male the antennæ are longer than half the body; sixth ventral prominent, deeply emarginate. The female has shorter antennæ; the fifth ventral rounded at apex, sixth not visible.

The above description is a transcript of the original, specimens not being at present before me.

From the label in the LeConte collection, it is evident that it was intended to describe it as a Copidita.

Cabo San Lucas, Sierra San Lazaro and San José del Cabo. Baja California.

Copidita bicolor Horn (*Ditylus*) Trans. Am. Ent. Soc., 1870, p. 88.

Nearly as robust as *obscura*, color above and beneath bluish, thorax red. Antennæ black, not close to the eye at base. Head blue, rather coarsely not densely punctate. Thorax not wider than long, sides arcuate in front, obliquely narrowed behind, surface shining, with coarse, irregularly placed punctures, color red, the basal margin black. Elytra blue, feebly shining, densely punctate,

Asclera erythrocephala Germ., *Œdemera*, Ins. Nov., p. 167.

Form slender, totally black, the front and occiput always and the middle of thorax sometimes yellow. Head shining, sparsely, indistinctly punctate. Thorax slightly wider than long, sides arcuate in front, oblique posteriorly, disc not foveate but slightly transversely impressed in front, flattened posteriorly, surface shining, not closely punctate. Elytra densely punctate, the costæ moderately distinct. Body beneath more shining, abdomen finely and sparsely punctate. Length .16–.32 inch.; 4–8 mm.

In the male the last ventral is shorter and with a small acute emargination at middle, in the female the segment is acute.

Occurs in Georgia.

Asclera nigra Lec. Ann. Mag. Nat. Hist., 1869, p. 379.

Form slender, totally black, opaque. Head closely punctate and alutaceous. Thorax as in *discolor*, the disc with a moderately deep fovea each side and one less distinct at middle of base, surface densely punctate and alutaceous. Elytra densely punctate, the costæ well

coarsely punctate, slightly alutaceous. Thorax broader than long, sides arcuate in front, oblique behind, disc rather depressed, moderately closely punctate and alutaceous. Elytra often slightly purplish, densely punctured and opaque, the costæ well marked. Beneath shining, less closely punctate. Length .26–.32 inch.; 6.5–8 mm.

In the male the last ventral segment is shorter, truncate, the middle slightly produced. In the female the last ventral is longer, each side oblique, the center produced in a point.

Occurs in Colorado and Texas.

Asclera ruficollis Say. *(Œdemera)* Journ. Phil. Acad., iii, p. 271; ed. Lec., ii, p. 160.

Form slender, black, with thorax red. Head moderately densely punctured and alutaceous. Thorax broader than long, the sides arcuate in front and oblique behind, disc with three foveate depressions; the posterior less deep, surface opaque, alutaceous, without punctures except a row of coarse punctures near the base. Elytra densely punctured and opaque, and with three dorsal costæ very well marked. Body beneath more shining than above and rather densely punctured. Length .20–.26 inch.; 5–6.5 mm.

In the male the last ventral is shorter and broadly truncate, in the female longer and slightly produced at middle.

Occurs from Pennsylvania to Texas.

Asclera excavata Lec. Ann. Lyc. N. Y., v, p. 158.

Form slender, black, elytra with faint bluish tinge, thorax red. Head moderately closely punctate. Thorax slightly longer than wide, sides strongly arcuate in front, oblique posteriorly, disc vaguely trifoveate, the surface shining and sparsely punctate. Elytra densely punctured,

the costæ well marked. Body beneath more shining, slightly blue or green. Abdomen finely punctured. Length .26–.32 inch.; 6.5–8 mm.

In the male the last ventral is shorter and less produced at middle, the last dorsal is more acute. In the female the last ventral is quite acutely produced at middle.

This species resembles *ruficollis*, but the sculpture of thorax will readily separate the two species.

California and Nevada.

Chrysanthia Schmidt.

Form slender. Head moderately elongate. Eyes entire, rather finely granulate. Antennæ slender, eleven-jointed in both sexes, inserted at a distance from the eyes. Terminal joint of maxillary palpus triangular, widest beyond the middle. Mandibles bifid at tip. Tibiæ with two terminal spurs. Penultimate joint of tarsi alone spongy-pubescent beneath. Claws simple.

In this genus I place one species, which, from its appearance, has been associated in all collections with *Oxacis (bicolor)*.

Chrysanthia repanda n. sp.

without an examination of its head and mandibles, it might be mistaken for that species. The only variation observed is in the color of the elytra, which may be black or blue, with an intermediate bronze.

While there is a possibility of doubt as to the correctness of its reference to Chrysanthia, I can find nothing in the descriptions of the latter to warrant any other course.

Specimens are known to me from the District of Columbia, Florida, Texas, and Arizona (Yuma).

Sisenes Champion.

Form slender, somewhat recalling Lycidæ. Head moderately elongate. Eyes oblique, scarcely emarginate. Antennæ slender, eleven-jointed, inserted at a distance from the eyes. Mandibles bifid at tip. Terminal joint of maxillary palpus elongate-oval. Tibiæ with two terminal spurs. Claws simple.

One species is known to me in our fauna, and I have no doubt of the correctness of its association with Sisenes, but it possesses certain peculiarities which seem not to belong to the other species. The head is certainly more prolonged than the figures of Mr. Champion's species indicate, and his description merely says "a little prolonged." The antennæ are distant at base from the eyes, more so than in any species I have seen, excepting Rhinoplatia.

This insect seems to illustrate fully the difficulties encountered, even in a limited fauna like our own, in endeavoring to arrive at some proper understanding of the limits of the genera. In other words, this species seems to bear the same relationship to the others that the species I have called *Chrysanthia repanda* bears to *Copidita thoracica*.

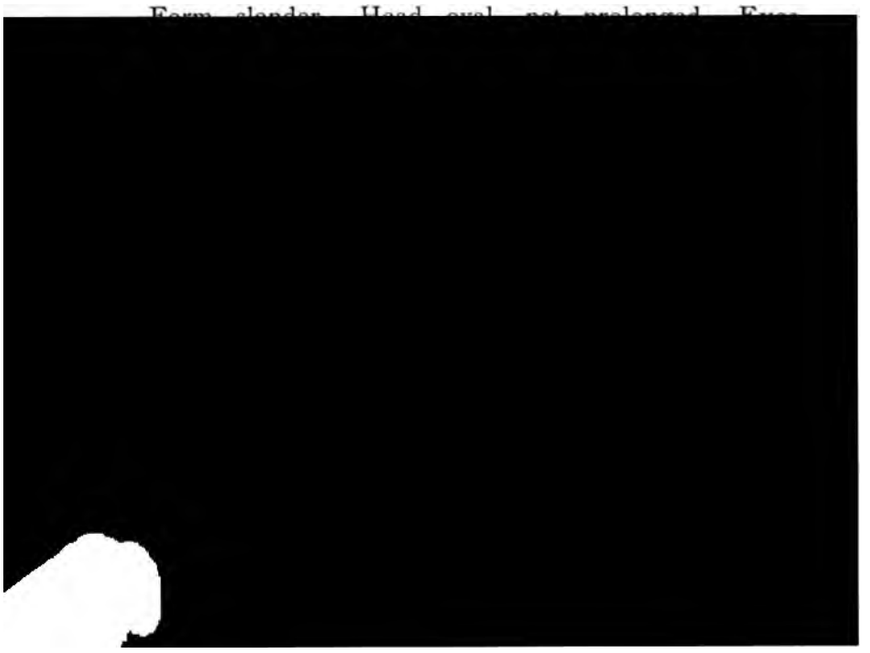
Sisenes championi Horn, Proc. Cal. Acad. Sci., 1894, p. 435.

Form moderately slender, somewhat lyciform; head, body beneath, and legs bluish, submetallic, elytra reddish orange. Head not densely punctate, antennæ black, eyes distant from prothorax. Thorax longer than wide, cylindrical, slightly arcuately broader, one-third from apex, disc somewhat irregular, color deep blue, with an irregular orange stripe each side, with similar pubescence, surface moderately closely punctate. Elytra nearly twice as wide at base as the thorax, gradually broader posteriorly, disc finely tricostulate, color reddish orange, with fine short pubescence of similar color. Surface beneath sparsely punctate. Length .36–.40 inch.; 9–10 mm.

In the male the fifth ventral segment is broadly not deeply emarginate, the sixth segment prominent, deeply divided, the lateral parts slightly arcuate and concave. The female has the fifth ventral obtuse with a median impression.

Occurs in southern Arizona (Morrison).

Oxacis Lec.



termediate forms occur. In our own species I have observed that the claws vary in the different tarsi in the form of the tooth, and even in the same tarsus the claws are not identical. It is, however, quite sure that the use of Probosca for those with toothed claws is entirely inapplicable, as that genus has not only a prolonged head, but also simple claws.

On the other hand it seems unwise to retain in the same genus, species in which both mandibles are acute at tip, and those in which the right mandible is practically bifid. Four species possessing the latter character are now known to me, and will be separated.

In Oxacis Mr. Champion (loc. cit., p. 151) admits a species in which "the joints preceding the penultimate one" of the tarsi are "tomentose beneath." If this must be admitted, the classification of the genera of the family becomes one of some difficulty.

Three of the species formerly included in this genus have been removed to Copidita, as the mandibles are bifid.

The species at present known may be separated in the following manner:—

Claws simple. 2.
Claws acutely toothed. 12.
2.—Last joint of maxillary palpi subcultriform, widest near the base, apical side longer than the inner. 3.
Last joint of maxillary palpi triangular, widest at or beyond the middle. 9.
3.—Thorax very distinctly punctate. 4.
Thorax shining, scarcely at all punctate, devoid of pubescence. *lævicollis.*
4.—Terminal joint of maxillary palpus subacute. 5.
Terminal joint rounded at tip; color entirely yellowish testaceous. *fragilis.*
5.—Thorax with disc somewhat concave; color pale piceous or brownish. *granulata.*
Thorax convex. 6.
6.—Elytra subcostulate, indicated by lines of denser pubescence. 7.
Elytra not subcostulate. 8.

7.—Elytra pale; legs pale.
  Terminal joint of maxillary palpus one-half longer than the preceding; antennæ piceous. *pallida*.
  Terminal joint not longer than preceding; antennæ pale. *sororia*.
Elytra nearly black, thorax red, legs black. *floridana*.
Elytra and thorax piceous, pubescence gray and coarse. *grisea*.
8.—Antennæ black. *cana*.
  Antennæ pale to piceous, never black. *tæniata*.
9.—Elytra piceous. 10.
  Elytra testaceous. 11.
10.—Head and thorax entirely yellow, not strongly punctate. *bicolor*.
  Head and thorax partly piceous, coarsely and rather closely punctate. *dubiosa*.
11.—Pubescence dense, entirely concealing the sculpture, claws slender. *sericea*.
  Pubescence not dense, sculpture visible; claws stouter at base. *subfusca*.
12.—Elytra closely punctulate over the entire surface. *lucana*.
  Elytra rather sparsely punctate, very feebly so at apex; form slender. *debilis*.

Oxacis lævicollis n. sp.

Slender, piceous, head and thorax pale, elytra nearly black with suture narrowly paler. Head pale, with piceous spot between the eyes, surface sparsely punctate. Antennæ brownish. Thorax longer than wide, sides feebly arcuate in front and but little narrowed posteriorly, disc

in fact brownish, with a very smooth thorax and with elytra not densely punctured. It probably indicates a distinct species, but, as it is unique and evidently immamature, it is passed with simple mention.

Two specimens, Arizona.

Oxacis fragilis n. sp.

Form slender, yellowish, testaceous, surface with rather coarse not dense pubescence. Head sparsely punctate, rather shining. Thorax as wide anteriorly as long, sides in front rather strongly arcuate, posteriorly narrowed, with slight sinuation, disc not densely punctate, moderately shining, the surface somewhat irregular. Elytra slightly more coarsely punctate than the thorax, moderately closely, without traces of costæ. Body beneath finely punctulate and shining. Length .25–34 inch.; 6.25–8.5 mm.

The last joint of maxillary palpus is distinctly cultriform, rounded at tip. The spurs of all the tibiæ long and slender. This species resembles some of the entirely pale varieties of *lucana*, but the simple claws distinguish it from that.

The specimens are from Utah, Arizona, San Diego, California, and San José del Cabo.

Oxacis granulata Lec. New Species, p. 166.

Slender, pale piceous or brownish. Head closely punctate. Thorax slightly longer than wide, disc somewhat concave, closely punctate, more finely at the sides. Elytra granulately punctate, without costæ. Length .25–.30 inch.; 6.25–7.5 mm.

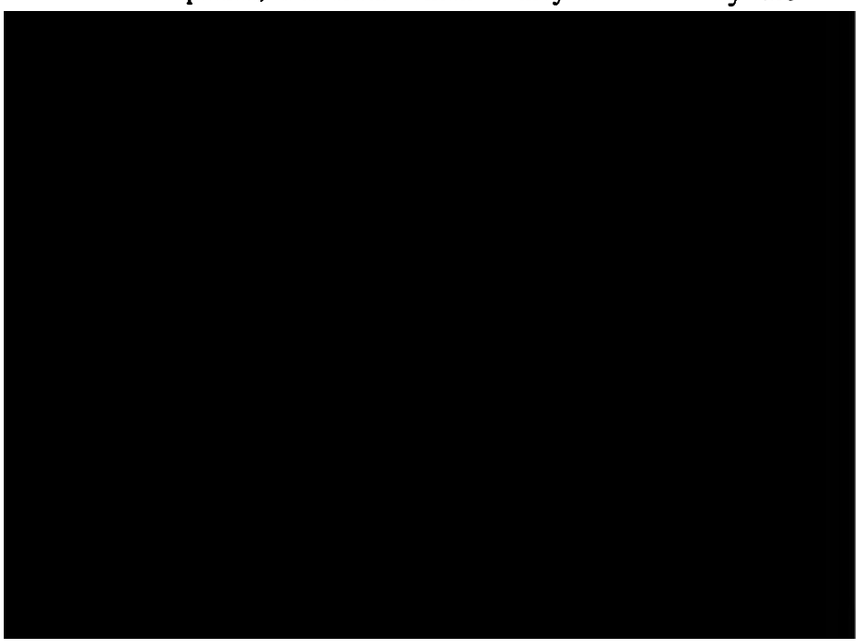
The last joint of maxillary palpus is of elongate cultriform shape, acute at tip. The claws are feebly dilated at base.

Two specimens in LeConte's cabinet, from Cabo San Lucas, Baja California.

Oxacis pallida Lec. *(Asclera)* Proc. Phil. Acad., 1854, p. 224.

Paler piceous, sparsely pubescent. Antennæ piceous. Maxillary palpi with terminal joint cultriform, obtuse at tip, and distinctly longer than the preceding joint. Head pale with frontal piceous area, surface moderately coarsely punctate and alutaceous. Thorax distinctly longer than wide, sides arcuate in front, obliquely narrowed posteriorly, disc regularly convex, moderately closely punctate and alutaceous, color reddish yellow, with a median short piceous vitta and a small spot each side. Elytra piceous, the suture, side-margin, (more widely) and the costæ paler, these latter well marked, surface moderately closely punctate,with short not dense pubescence. Body beneath piceous, finely, densely punctate, and finely pubescent. Legs pale, outer half of femora piceous. Length .34 inch.; 8.5 mm.

A well marked species easily known by the distinctness of the elytral costæ in which it agrees with the next two species, but from which it may be known by the



well marked. Body beneath slightly darker than above, densely punctate. Legs pale. Length .25–.40 inch.; 6.25–10 mm.

In the small group of species with well-marked elytral costæ, this one has much coarser and denser pubescence. The antennæ and legs are always pale, and the terminal joint of maxillary palpus not longer than the preceding joint.

It is probable that this species is confounded with *pallida* in collections.

Occurs in Utah, Texas and Arizona.

Oxacis floridana n. sp.

Entirely piceous black, with sparse cinereous pubescence, thorax reddish yellow. Head moderately densely punctate. Thorax about as wide as long, sides arcuate in front, obliquely narrowed to base, disc somewhat irregular, densely punctate. Elytra piceous black, with faint purplish tinge, surface rather densely punctate, very distinctly bicostulate on the disc. Body beneath finely and densely punctulate. Legs black. Length .40 inch.; 10 mm.

The last joint of the maxillary palpi is one-half longer than the preceding, cultriform and acute at tip.

One specimen, Florida.

Oxacis grisea n. sp.

Form less slender, piceous, faintly paler along the suture and side margin of elytra, surface with rather coarse grayish white pubescence. Antennæ brownish. Terminal joint of maxillary palpus elongate-cultriform and acute at tip. Head rather coarsely and closely punctate. Thorax longer than wide, the sides in front feebly arcuate, posteriorly narrower, disc regularly convex, the punctuation moderate in size and not dense. Elytra moderately

densely punctate, the costæ not very strongly marked. Body beneath piceous, abdomen rather densely and finely punctate. Legs piceous, femora paler at base. Length .37 inch.; 9.25 mm.

This species may be known by the coarse and rather dense grayish white pubescence.

Two specimens, Texas.

Oxacis cana Lec. *(Asclera)* Proc. Phil. Acad. 1854, p. 225.

Piceous, thorax reddish yellow, elytra with the suture and an outer vitta testaceous. Head piceous, sometimes more or less testaceous, closely punctate. Thorax slightly longer than wide, sides arcuate in front, slightly sinuately narrowed posteriorly, disc regularly convex, moderately closely punctate. Elytra piceous, moderately closely punctate, feebly pubescent, suture pale and a pale vitta extending from humerus nearly to apex. Body beneath piceous, finely punctate, and more distinctly pubescent than above. Length .22–.38 inch.; 5.5–9.5 mm.

This species varies slightly in color. The thorax is more often immaculate, but specimens occur with an elongate median piceous stripe and a small spot each side.

densely punctured. Elytra rather more finely and densely punctured than the thorax, without trace of costæ. Beneath finely and densely punctured. Length .18–.28 inch.; 4.5–7 mm.

Typical form. Head and thorax yellowish, the latter with a piceous spot each side. Elytra piceous with the suture narrowly pale. Body beneath pale, abdomen piceous, legs pale.

The piceous spaces at the sides of thorax extend so that the entire surface may be piceous.

Specimens with the thorax entirely piceous have often the elytra somewhat blue but with the pale suture. These have the legs piceous to a variable degree.

Other specimens have the characters of the preceding, but the suture is not pale and the legs are entirely so.

In the two last mentioned forms the entire surface beneath is piceous.

Occurs in Georgia, Florida, and Texas.

Oxacis bicolor Lec. *(Asclera)*, Ann. Lyc. N.Y., v, p. 158.

Form very slender, piceous, head, thorax and legs yellow. Antennæ piceous, slightly paler at base. Head shining, sparsely punctulate. Thorax longer than wide, sides feebly arcuate in front, oblique posteriorly, very slightly narrowed to base, disc feebly convex, shining, rather coarsely not closely punctate. Elytra more finely punctate than the thorax, moderately closely punctate, pubescence short and dark, without traces of costæ. Metasternum and abdomen piceous, very finely, sparsely punctate. Femora yellow, tibiæ and tarsi piceous. Length .20–.32 inch.; 5–8 mm.

Excepting in size there has been no variation observed.

Occurs from British Columbia southward through Washington, Oregon, California, Nevada, and Arizona.

Oxacis dubiosa n. sp.

Form slender, piceous, thorax paler at apex and base, suture narrowly pale. Antennæ piceous to parti-colored, usually darkest at base. Head somewhat variable in color, from piceous to partly yellow, moderately coarsely punctate. Thorax longer than wide, sides feebly arcuate in front, slightly narrowed to base, disc regularly convex, moderately coarsely and densely punctate, color variable. Elytra moderately densely punctate, without costæ, with fine grayish pubescence. Body beneath piceous, finely punctulate. Femora at basal half yellow, tibiæ and tarsi piceous. Length .20–.24 inch; 5–6 mm.

The thorax is more or less piceous, the apex and base always paler. Specimens occur with the thorax reddish yellow, with a broad well defined piceous transverse band at the anterior third, the apical edge being reddish.

San José and San Lazaro, Baja California.

Oxacis sericea Horn, Trans. Am. Ent. Soc., 1870, p. 89.

Piceo-testaceous, densely clothed with grayish white pubescence entirely concealing the surface. Antennæ pale. Head moderately densely punctate. Thorax as wide as long, sides rather strongly arcuate in front, narrower posteriorly, disc slightly irregular, closely, finely punctate, color testaceous with an indistinct piceous vitta

Oxacis subfusca n. sp.

Slender, brownish, testaceous, clothed with very short, not densely placed pubescence. Antennæ pale. Head coarsely and moderately closely punctate. Thorax longer than wide, sides moderately strongly arcuate in front, the posterior half parallel to base, surface regular, densely, not coarsely punctate, sometimes with a smooth median line, color brownish testaceous, the sides often darker. Elytra densely not coarsely punctate without trace of costæ, color pale brown with a faint trace of a darker vitta. Body beneath darker than above, with longer pubescence. Legs pale. Length .30–.32 inch.; 7.5–8 mm.

This species resembles *fragilis* of the group with cultriform palpi, but is somewhat darker in color and more opaque.

Occurs in southern Arizona.

Oxacis lucana Lec. *(Probosca)*, New Species, 1866, p. 167.

Variable in color from piceous to testaceous, with intermediate forms with vittate elytra. Antennæ always pale. Head moderately coarsely not densely punctate. Thorax longer than wide, sides feebly arcuate in front, posteriorly gradually convergent, disc slightly irregular, surface densely punctate. Elytra moderately densely punctate, without trace of costæ. Body beneath variable in color. Leg always pale. Length .25–.32 inch.; 6.5–8 mm.

The pubescence of the surface is always short, gray, and sparse. The terminal joint of the maxillary palpus cultriform. The claws acutely toothed. The color is very variable. The thorax has more or less distinctly a median piceous vitta and each side a spot. The elytra may be entirely piceous or testaceous, but specimens occur with distinct traces of vittæ.

This species was described as a Probosca, but for what reason is not evident. Mr. Champion in the Biologia has properly indicated its position in Oxacis.

Occurs not rarely at Cabo San Lucas, Baja California, and I have one from Yuma.

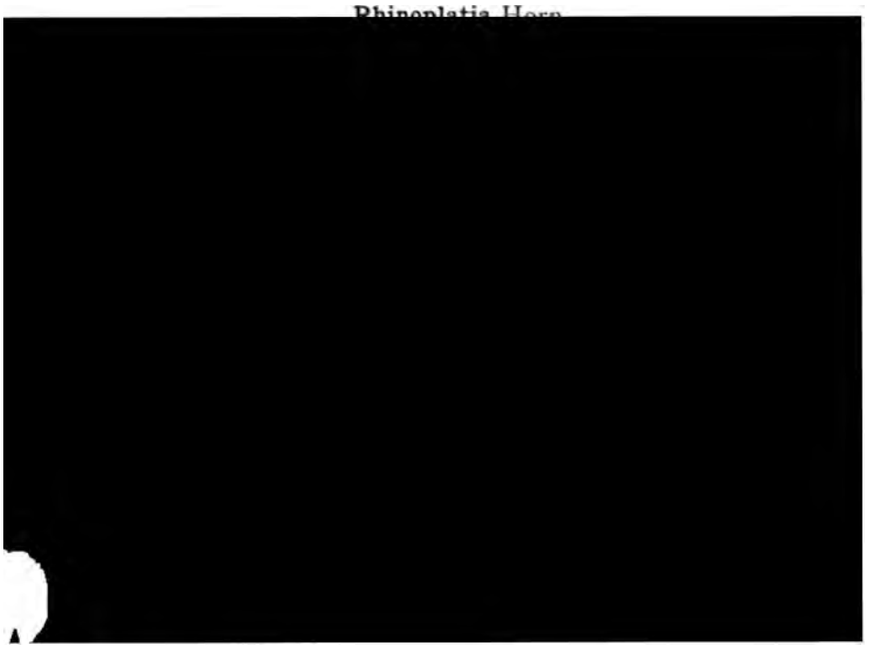
Oxacis debilis n. sp.

Form slender, elongate, pale yellowish testaceous, very sparsely pubescent. Head sparsely, obsoletely punctate. Thorax not longer than wide, sides arcuate in front, oblique posteriorly, disc somewhat irregular, obsoletely coarsely, not densely punctate, the surface alutaceous. Elytra rather shining, obsoletely costulate punctate, but nearly smooth at apical third. Body beneath pale, sparsely punctate and pubescent. Legs pale. Length .22–.26 inch.; 5.5–6.5 mm.

This species resembles some of the paler forms of *lucana*, but it is more slender, with smoother elytra. The maxillary palpi have a cultriform terminal joint. The claws are toothed at base, but less acutely than in *lucana*.

Two specimens, Yuma, California.

Rhinoplatia Horn



Stenostoma, the latter having also simple mandibles, but distinguished by other characters.

One species only is known.

Rhinoplatia ruficollis Horn, Trans. Am. Ent. Soc., 1867, p. 137.

Form less slender than usual in Oxacis or Asclera, piceous with griseous pubescence, thorax reddish yellow, Head sparsely punctate at sides, smooth at middle. Thorax distinctly longer than wide, sides feebly arcuate in front, sinuately narrowing posteriorly, disc regularly convex, surface very sparsely punctate and shining. Elytra densely punctate and with very vague costæ. Body beneath and legs piceous, abdomen finely and closely punctate, the pubescence longer than on the upper surface. Length .24–.36 inch.; 6–9 mm.

No sexual differences have been observed.

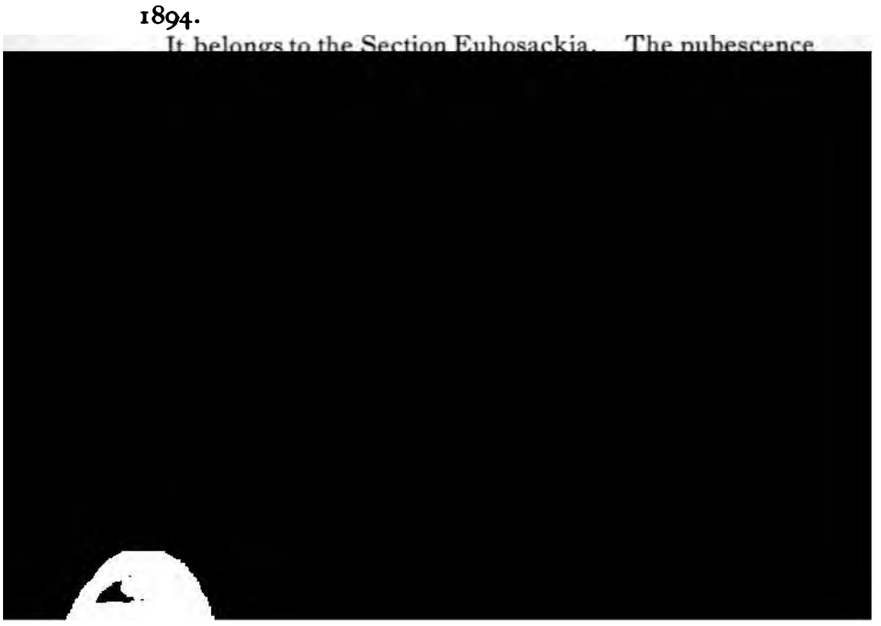
Occurs in Owens Valley, on the east of the Sierras, and in Kern County to the westward, in California.

Hosackia rosea n. sp. Plate lv.

Stems low, numerous, from spreading rootstocks, flowering from the lowest axils; leaflets 7–11, glabrous above, glaucous and sparingly white-villous beneath, 5–6 mm. long, petiolulate, obovate, mucronate (the odd leaflet is truncate); rhachis and short petiole 1–2½ cm. long, villous-pubescent, becoming glabrous; stipules thin but not scarious, lanceolate-acuminate, 2–3 mm. long; peduncles 3–4 cm. long; bracts of 1–5 leaflets, 1–2 cm. from the umbel; flowers rose-color, 5–8 on short pedicels, subtended by an involucre of 5–6 short teeth; calyx campanulate, 4 mm. long, tinged and obscurely veined with dark rose-color, especially on the 5 unequal, villous-ciliate, triangular teeth; standard orbicular, emarginate, 6 mm. wide; wings broad, much surpassing the keel which is marked by parallel lines and blotches of a deeper crimson; anthers orbicular, the line between the cells brown or dark red; immature pod linear, straight, compressed, usually 10-seeded.

This pretty little Hosackia formed mats at the edge of the brush, near Fort Bragg, along the road to Glen Blair; also on the road to Ukiah, near Mendocino City. It was collected by the writer in the former locality, June 22, 1894.

It belongs to the Section Euhosackia. The pubescence



Anemone Californica n. sp. Plate liv.

Slender, from 10–14 cm, high, villous-canescent, with soft, silky hairs; stem almost glabrous; the lowest leaves with petioles sheathing and scarious at base for about 3½ cm. (the scarious part is 5 mm. wide, parallel-veined and densely white-villous on the margin), petioles 1 cm. long above the dilated base; the other radical leaves are on slender petioles 2–4 cm. long; blade orbicular-ovate in outline, biternately compound, with palmately cleft, unequal, linear divisions which unite into leaflets cuneate at base; involucral leaves 3, pedately compound, on petioles 2–4 mm. broad, 8 mm. long, ultimate divisions linear, acute, 4–9 mm. long, 1 mm. broad: flowers purplish blue, 3–4 cm. in diameter; sepals 6–8, villous on the back, especially on the median line, obovate, 18 mm. long, 8 mm. wide; stamens numerous, on slender filaments; carpels 40–50 on a conical receptacle; akenes somewhat white-villous, falcately club-shaped; style naked, 2 mm. long (immature), curved at the apex and slightly glandular.

This Anemone belongs to the Section Euanemone, but in habit resembles *A. occidentalis*, Watson, of the preceding section, though not so tall. The naked styles, however, remove it from that section. There is often a second flower, also with involucre, as shown in the figure.

Mr. J. R. Scupham, a member of the California Academy of Sciences, is the discoverer of this rare Anemone. He collected it on a mountain near Lot's Lake, in the neighborhood of Golden Summit Mountain, at the extreme western portion of Plumas County on the Butte County line, north of the North Fork of Feather River.

The type material is in the Herbarium of the California Academy of Sciences.

The type is in the Herbarium of the California Academy of Sciences. Duplicates have been sent to the Gray Herbarium and the National Herbarium.

Heuchera cæspitosa n. sp. Plate lvii.

Cæspitose, from stout rootstocks covered with dead leaves; glandular throughout; leaves round-reniform, 2 cm. wide, crenately lobed, ciliate on the margin and aristate at the apex of each crenature; petioles 1–2 cm. long, glandular and villous, with long spreading white hairs; the epidermis on the lower surface is loose and puffed out between the veins: scapes 1–2 dm. high, slender, cymose-paniculate, bracts laciniately bristly and glandular-ciliate, 5 mm. long: lowest branches of the panicle 2 cm. long; calyx 7 cm. long, campanulate, attenuate to a slender pedicel, slightly contracted above the ovary, purplish at the lower part of the tube, paler above, 5-cleft, with round, obtuse, greenish, or purplish divisions, densely hairy above, glandular below; petals exserted, 4 mm. long, with blade equalling the claw, oblong, acute, with a gland at the point of insertion; stamens inserted below the petals on stout filaments, anthers orbicular, orange; stamens and styles hardly ex-

Brodiæa Purdyi n. sp. Plate lviii.

Scapes 1-several, 10–15 cm. above ground, from a corm heavily fibrous-coated, generally with 1 or 2 large offsets; leaves thick, 3 mm. wide, deeply grooved on the inner side, equalling the scapes; bracts of the umbel conspicuous, scarious, triangular-acuminate, with a red midvein; pedicels spreading gracefully; perianth with throat constricted above the ovary, tube 7 mm. long, segments linear-oblong, spreading widely and recurved, blue, with a darker midvein, outer a little shorter and narrower than the inner which are about 2 cm. long and 4 mm. wide; staminodia erect, white, strongly involute, 13 mm. long, 3 mm. wide; apex dentate or emarginate; stamens two-thirds as long as staminodia, deeply emarginate, connivent with the staminodia on the constricted throat of the perianth; ovary obconic, attenuate to a short stipe.

This comes under Hookera, according to Professor Greene (Bull. Cal. Acad. Sci., v. 126). It differs from other members of the group in the constricted throat of the perianth and the segments so much longer than the tube. It is the most beautiful and graceful of the group. The white petaloid staminodia have the appearance of a corolla within the perianth. The anthers are extrorse and closely surround the pistil.

This species was communicated by Mr. Carl Purdy, who collected it in the foothills of the Sierra Nevada Mountains, from Colfax to the hills back of Chico.

It seems appropriate to name this in honor of Mr. Purdy, who is so well known in connection with Californian Liliaceæ.

The type is in the Herbarium of the California Academy of Sciences.

Cynoglossum viride n. sp. Plate lix.

Stems several, from woody, horizontal rootstock, 1½–2 dm. high, covered at base with brownish, ovate-lanceolate scales; silky-canescent throughout, with downward-appressed hairs that become spreading with age; lowest leaves 8–14 cm. long, linear or oblanceolate, on long, margined petioles; middle leaves sessile by a broad base, oblong, obtuse or bluntly pointed, 14 cm. long, 2 cm. wide; uppermost leaves ovate-acuminate, much shorter than those on the middle of the stem; flowers in a capitate cyme, at first almost sessile and surrounded by the leaves, the cyme becoming looser and the peduncle elongating with age (6–9 cm. long); pedicels 5 mm. or less in length, pale-fulvous, with shining, appressed hairs; divisions of the calyx linear-oblong, obtuse, 5–8 mm. long; 1½ mm. wide, densely covered, especially on the midvein, with white or yellowish curly hairs; corolla tubular, dull yellowish green, 1 cm. long, with rounded lobes 2 mm. wide; crests in the throat obcordate; stamens with short filaments and anthers exserted from between the corolla lobes, but scarcely equalling them; style stout, surpassing the calyx, narrowing somewhat towards the clavate stigma, elongating after an-

collected by Mrs. R. M. Austin, in the Cascade Mountains, Oregon. Mr. Willis L. Jepson kindly compared flowers from the same plants with the types at the Gray Herbarium and reported them as identical.

The description of the fruit was made from specimens collected by Mr. Brandegee, at the Calaveras Grove of Big Trees. The plant figured was collected by the writer at Sequoia Mills, Fresno County, May 20, 1894. The description was made from specimens from that place, also from some collected by Mr. Brandegee at Frazer's Mills. It seems to be the southern analogue of *C. occidentale*, Gray, and grows in the timber belt of the southern Sierras, at an altitude of from 5000 to 6000 feet.

These type specimens are all in the Herbarium of the California Academy of Sciences. Duplicates have been sent to the Gray Herbarium and to the National Herbarium.

EXPLANATION OF PLATES.*

PLATE LIII.

Sedum Blochmanæ.

A. Entire plant, showing the manner of growth and flowering.
B, C, D and E. Petal, calyx, stamen and petals magnified.

PLATE LIV.

Anemone Californica.

A. This is a composite of two plants, one having lower leaves without a stem and the other possessing a stem but no lower leaves. The fragmentary material made this necessary. It was not reduced and is a little larger than the plant figured.
B. One of the involucral leaves spread out to show the divisions.
C. An open flower, about natural size. D. Pistil magnified ten diameters.

PLATE LV.

Hosackia rosea.

A. Part of a plant showing the manner of growth and flowering.
B. The standard magnified to show the shape of the blade and claw.

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*These drawings were designed for the new series of the Proceedings, the pages of which are to be a little larger; so, with the exception of Plate liv, they are all reduced more than was originally intended.

C. Wings and keel, indicating their connection and relative size.
D. Flower magnified, indicating the form and relation of the parts.
E. Keel magnified, with the wings removed.
F. Monadelphous stamens, and stigma.

PLATE LVI.

Lupinus rostratus.

A. Entire plant, slightly reduced in size.
B. Legume magnified a little less than twice, showing the position of the calyx and the withering-persisting petals.
C. Wings and keel separated to show the shape of the keel and the relative size of the two.
D, E and F. Young flower, banner, and calyx magnified a little less than five diameters.

PLATE LVII.

Heuchera cæspitosa.

A. Entire plant, separated from the thick mat of stems and leaves.
B. Flower dissected to show the position and relative size of the parts, and especially the insertion of the petals and stamens.
C. Flower, magnified five diameters and slightly reduced.
D. Pistil spread open to show the placentæ.

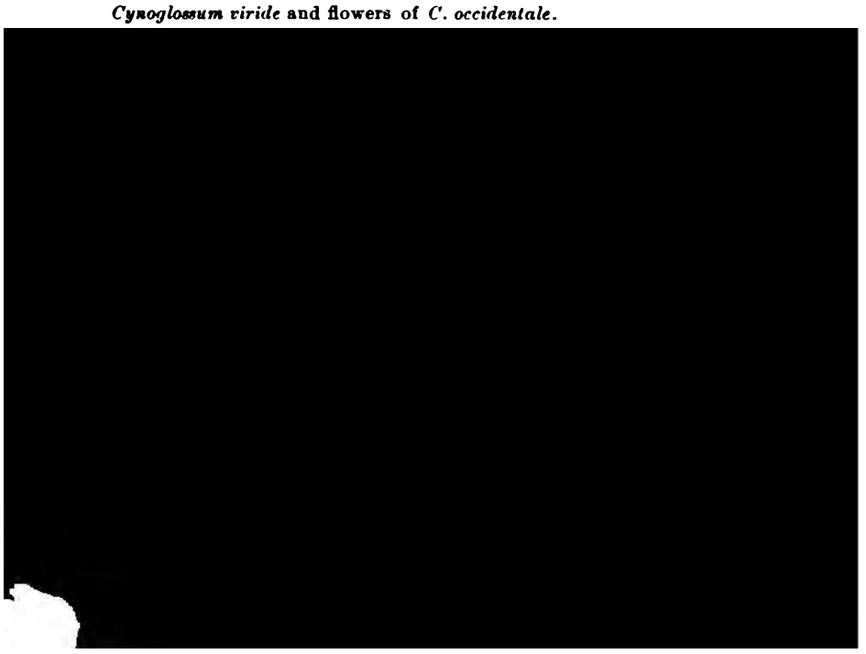
PLATE LVIII.

Brodiæa Purdyi.

A. Entire plant. The upper part of the leaves wanting.
B. Flower dissected to show the position and relative size of the parts.

PLATE LIX.

Cynoglossum viride and flowers of *C. occidentale.*



NEW MALLOPHAGA, II,—FROM LAND BIRDS; TOGETHER WITH AN ACCOUNT OF THE MALLOPHAGOUS MOUTH-PARTS.

(With Plates lx-lxxiii.)

BY VERNON L. KELLOGG.

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The Mouth-parts of the Mallophaga.
- Introduction.
- The Mouth-parts of Ancistrona gigas.
- The Mouth-parts of Læmobothrium sp.
- The Mouth-parts of Eurymetopus taurus.
- The Mouth-parts of Goniodes cervinicornis.
- Resumé.

The Mouth-parts of Some Allied Insects.
- The Mouth-parts of the Termitidæ and the Perlidæ.
- The Mouth-parts of the Psocidæ.
- Comparison and Conclusions.

Descriptions of New Species, and Identifications of Old Species..
- Docophorus.
- Nirmus.
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- Menopon.
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List of Hosts, with Parasites.
- Notes on Distribution.
- List.

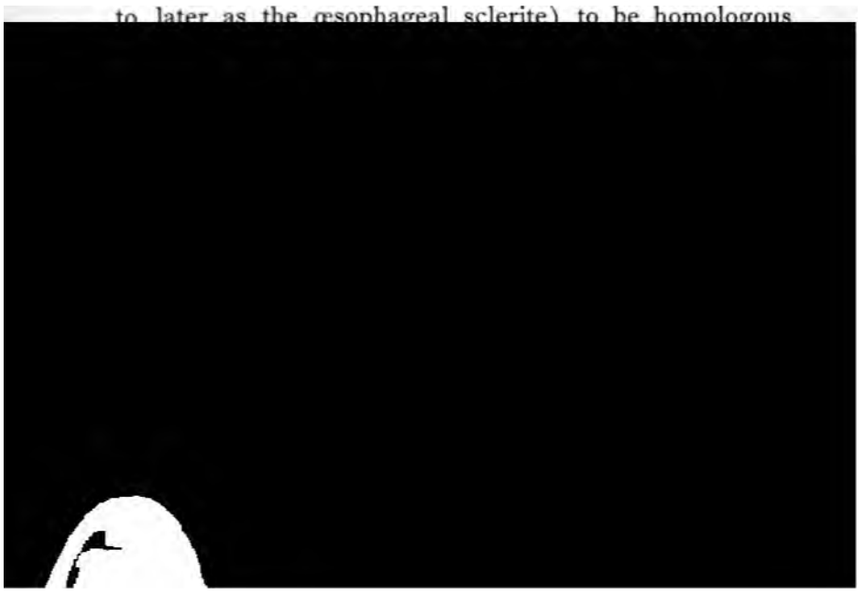
The Mouth-Parts of the Mallophaga.

The mouth-parts of the Mallophaga are of the biting Orthoptero-Neuropterous type; that is, they are of that generalized kind of insectean mouth-parts in which there are free, strong, laterally working mandibles, free jaw-like maxillæ composed of distinct basal sclerites, articu-

lated terminal lobes and segmented palpi, and a labium composed of the fused second maxillæ with similar basal and terminal sclerites and segmented palpi. But the Mallophagous mouth-parts represent a modified, a specialized condition of this simple type, in which the reduction of the maxillæ with the complete loss of their palpi and (in one suborder) the loss of the labial palpi, so confuse, at first glance, the homologies of the various structures, as to make the proper understanding of the mouth-parts a matter requiring some special attention.

Nitzsch, the first student of the Mallophaga, misunderstood the structure of the mouth-parts, holding the labial palpi to be maxillary palpi (see figs. 1, 2 and 3, plate lx), and his error was not corrected until Grosse*, in his careful dissections of *Tetraophthalmus chilensis* [=*Menopon titan*], made the matter plain.

† Rudow gives a most confused account of the mouth parts, having evidently made very superficial observation, although he declares himself to have made a most careful and exhaustive study of them. He concluded, from observation of the hypopharynx, that the Mallophaga should be classed with the sucking insects, and particularly with the Hemiptera. ‡ Melnikoff thought the peculiar chitin structure in the pharynx (referred to later as the œsophageal sclerite) to be homologous



sects. *Denny, †Giebel, ‡Piaget and §Taschenberg add nothing in their monographs to our knowledge of the mouth-parts. Giebel repeats Nitzsch's explanation of them; Piaget refers the palpi of the Liotheidæ to the maxillæ, and also says the labium of the Philopteridæ has 2-segmented palpi, referring doubtless to the paraglossæ; Taschenberg in his passing reference to the mouth-parts repeats Piaget's statements. ‖Grosse was the first to understand and to explain what seems really to be the true structure and homologies of the mouth-parts. He first indicated the labial character of the conspicuous palpi which are present in all of the Amblycera, called the labial palpar-like processes paraglossæ (see figs. 4 and 5, plate lx, *pg*), and gave some account of that sclerite in the œsophagus, which to my mind is so suggestive in its bearing on the phylogeny of the group. An abstract of Grosse's paper, by Prof. Geo. Macloskie, was published in the "American Naturalist," vol. xx, p. 340.

The following detailed accounts, with accompanying figures, of the mouth-parts of *Ancistrona gigas* P., *Læmobothirium* sp., *Eurymetopus taurus* N., and *Goniodes cervinicornis* G., are based on dissections made in my laboratory by Mr. R. E. Snodgrass, and are mostly in the words of his notes. The drawings also were made by Mr. Snodgrass.

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*Denny, Henry. Monographia Anoplurorum Brittanniæ, 1842, London.
†Giebel, Christoph. Insecta Epizoa, 1874, Leipzig.
‡Piaget, E. Les Pédiculines, 1880; Supplement, 1885, Leyden.
§Taschenberg, O. Die Mallophagen, 1882, Halle.
‖Grosse, Franz. l. c.

The Mouth-Parts of Ancistrona gigas.

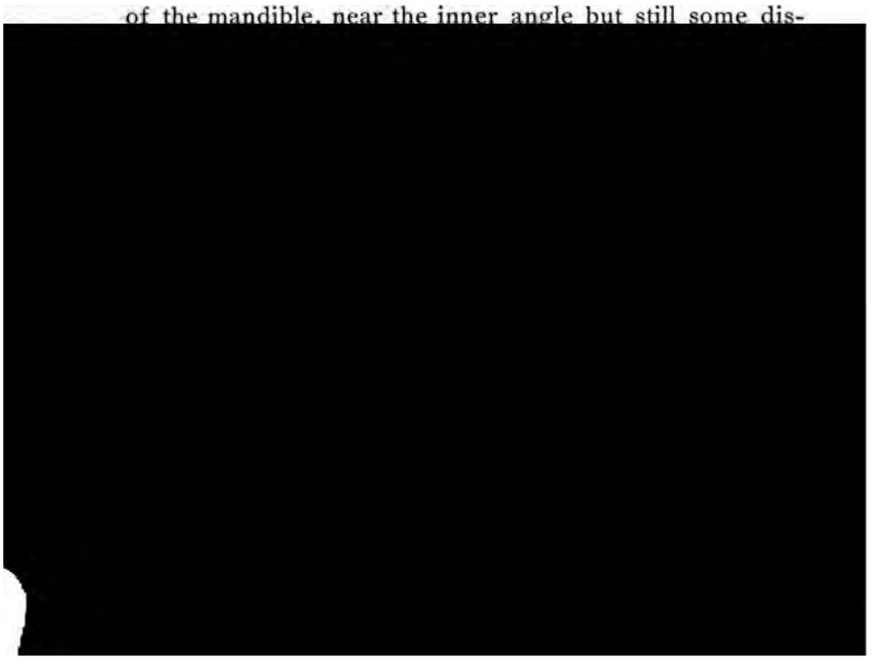
(Plate lx, figs. 6–12.)

In this form the full number of mouth-parts is present, and all are complete except the maxillæ, these lacking palpi and distinct sclerites. The labium is well developed and much longer than wide. It extends along nearly the whole length of the ventral surface of the head, the anterior border being situated far forward, leaving only the tips of the mandibles visible. When the palpi are parallel to the plane of the head their extremities project a little beyond the anterior lateral margin.

The *labium* (plate lx, fig. 7) consists of three distinct parts, the ligula, mentum and submentum together with prominent palpi. The mentum is the largest sclerite and bears the four-jointed palpi. It is somewhat wider than long, and is incompletely divided into three lobes, one placed medially and the others on each side of this. The median portion has the anterior border straight or a little concave, and articulates with the ligula. Each lateral lobe is narrow and projects anteriorly beyond the median portion which is much wider. Each bears distally a palpus. The latter is composed of four short joints of about equal length

dorsal prong is attached by its base to the mentum near the hind margin of the latter. From the posterior border of the mentum a deeply emarginated fold extends backward between the two forks, and is attached to the inner edge of the dorsal prong of each. In the young the emargination is much less, the fold being merely roundly concave posteriorly. In this stage it is attached for its full length along the median line to the submentum. In each fork the dorsal prong is rather flattened dorsoventrally; its outer edge is rounded inward proximally and outward distally, while the inner edge presents the same outlines, only in different order, so that the whole is doubly bent, first inwardly and then outwardly. The curvatures, however, are only slight, and the distal one is more marked than the other. The prong is much wider at its base than elsewhere, and tapers off very much distally. It ends by a triangular expansion, having one side of the triangle facing posteriorly and inwardly. At the base is an oval fossa, and in this the outer prong is articulated so as to allow of considerable movement. At the anterior outer corner of each fossa a large strong hair arises and extends outward and backward, being two-thirds or three-fourths the length of the fork. The ventral prong is more cylindrical than the other and tapers but little. It is almost straight, or slightly curved inwardly near the middle. Its base, however, curves dorsally, to be articulated with the other piece, as just described. It ends by a bluntly rounded termination which is very slightly ex panded. Its dorsal surface is covered by numerous fine, closely arranged, rounded ridges. Proximally these lie almost longitudinal, but they gradually become more transverse, so that the terminal ones form an angle of about thirty degrees with a transverse line through their inner ends. The ridges meet each other along the median

otherwise very similar to it. There are the same two teeth, but the posterior one is a little thicker than on the left side. The concavity on the ventral side is not so extensive, and the projection from the inner posterior angle is shorter and thicker. The articulatory condyle is similar in position, but is perhaps a little larger. The facet, however, is relatively more external. In each mandible there is a considerable extent beyond a line drawn from the condyle to the facet, but this is much shorter than that in the opposite direction; i. e., inwardly. Each mandible is supported by two large chitinous processes (plate lx, fig. 9, *d. ch. r.* and *v. ch. r.)*, arising from a common thick base which is attached to both the ventral and the dorsal wall of the head. One of these processes lies ventral to the other, and, in the case of the right mandible, a little internal to it. The ventral projection bears terminally a socket and the dorsal one a condyle; these articulate respectively with the condyle and facet of the mandible. The mandible is thus supported on an axis above which is all its weight; and further, the greater part of the latter falls on the inner side of the axis when the mandibles are in the resting position. To the posterior edge of the mandible, near the inner angle but still some dis-



rious in form, and whose functions are not definitely apparent, although they probably serve in some way for rasping or comminuting the food, or perhaps for holding it.

In the ventral wall of the pharynx is imbedded a chitinous rod or shaft, bearing two prongs at each end (plate lx, fig. 11, and fig. 6, *hy*.). The shaft is rather long and slender, with a swelling posterior to the middle. The posterior prongs are curved outward and backward, and also a little upward around the œsophagus. Their bases are very wide but they soon become narrower. Terminally each is somewhat expanded and ends bluntly. The anterior half of the wide basal portions is much thinner than the rest, and the shaft appears between the two as a wide elevated ridge, continuous with the posterior thickened borders. A large oval foramen, having its long axis extending from within outwardly and posteriorly, is situated between the thin part, the thickened shaft, and the posterior elevated margin. The anterior fork projects into the mouth, dorsal to the anterior end of the labium, in the position of a hypopharynx. The prongs of this bifurcation are much smaller than those of the other and project outward and forward. The entire length of the structure in a specimen measured is .52 mm. The part projecting is about a fifth of the whole. All but this latter part is imbedded in the ventral wall of the pharynx and is not visible from above. It is evident that it must be developed from an invaginated portion of the cuticle which became strongly chitinized and constricted off from that lining the mouth. The two anterior prongs have on their anterior edges each a padlike, soft, unchitinized structure. Each pad is distally surmounted on the dorsal surface by a large cluster of rather long, thick, curved processes, radiating from a common center and curving upwards.

All have their concave borders facing one another and the center from which they spring. Along the convex surface of each is a fringe of cilia inclined distally. The rest of the pad is covered by short, thick projections, lying with their long axes parallel to the surface and curving over to the dorsal side, where they become scale-like in form. Between this hypopharynx and the labium is a fold of membrane from which project the anterior ends of two other structures. There are two chitinous rods (plate lx, figs. 6, *fk*, and 12) whose anterior forked ends project through this fold and lie beneath and a little external to the hypopharynx. They may be exposed by removing the labium. Each lies ventral to all the other organs in the head. Posteriorly they diverge from each other and pass backward, ventral to the lower edge of the tentorium, and are attached to the ventral wall of the head by muscles. They are very slender and delicate on account of their thinness and being not very strongly chitinized. Anteriorly each is rather expanded and flattened dorsoventrally, but posteriorly becomes narrower and more cylindrical. The outer prong of the anterior bifurcation is wide and thin, the other is longer, narrower, a little curved outwardly, and rather

The Mouth-Parts of Læmobothrium sp.

(Plate lxi, figs. 1–5.)

The *labium* of *Læmobothrium* sp. (plate lxi, figs. 1 and 4) consists of submentum, mentum, palpi, and ligula. The labium as a whole occupies two-thirds of the length of the ventral surface of the head. Its anterior border lies in front of the bases of the antennæ, and extends also considerably farther forward than the bases of the mandibles; hence the latter are almost concealed by the labium.

The submentum (plate lxi, fig. 4, *sm.*) is a transversely narrowed sclerite very convexly rounded posteriorly, and slightly concavely rounded laterally where it joins the temporal sclerites. The anterior border is more decidedly concave and articulates with the convex posterior border of the mentum. The submentum is a little wider than half its length, and on the whole is somewhat narrowly shield-shaped. In front of the submentum is the mentum (plate lxi, fig. 4, *m*). This sclerite is wider than long and is somewhat oval in outline, with the long axis transverse; the latter is a little in front of the middle point. The lateral and posterior borders are very convex, and the sclerite may also be regarded as being an isosceles triangle with the angles very much rounded, and the apex pointing backward. Laterally there are two short thick, anterior prolongations, *pf*, one on each side. These bear the short four-jointed labial palpi. Each segment of the palpus is rather short and cylindrical and bears a few hairs. The terminal one is shorter than the others and forms a rounded termination to the palpus. The ventral surface of the mentum is produced downward into a large saccular or pouchlike distention which is almost as wide and long through its greatest diameters as

the mentum itself. Where the pouch joins the mentum, however, it is narrower than it is a short distance below; it therefore expands a little ventral to its dorsal border. In a mounted specimen the pouch may be pressed down flat against the rest of the labium, and then its anterior border appears to be a fold of membrane extending over the ventral surface of the ligula from the anterior edge of the mentum. Within this pouch are two large glands (plate lxi, fig. 5) lying side by side, one on each side of the median line. They are narrower anteriorly where they open into the mouth cavity near the anterior edge of the labium. Posteriorly they become enlarged and turn outward.

The ligula is composed of glossæ and paraglossæ. The glossæ are flattened lobes, one on each side of the middle line, and separated from each other for about two-thirds their length. Each is about as wide as long, and the anterior border slopes slightly outward from within. The outer borders are straight. The paraglossæ lie just exterior to the glossæ. Each is conical with the end truncated, and is a little longer than the glossæ.

The *maxillæ* (plate lxi, figs. 1, *mx*, and 3) are simple lobes expanded distally but narrow at the base. Each projects inwardly and forward, and lies just back of the mandibles

ginal thickening and perpendicular to it, the latter lying close to the edge, just back of the teeth. Near the base of the maxilla on the inner side is attached a large muscle, as large as the maxilla itself. This large muscle and the strong teeth seem to indicate that the maxilla is not functionless, but that it plays some part in the mastication of the food.

The *mandibles* (plate lxi, fig. 2) are the same in general shape and position as those of *Ancistrona gigas*. Those of the two forms present corresponding processes, and in each they lie in a plane parallel with the head. They are in both triangular in general outline viewed dorsoventrally.

The right mandible of *Læmobothrium* has at its anterior inner corner a large, strongly chitinized tooth, which is a continuation inward and forward from the ventral surface of a strong anterior thickening of the mandible. Posterior to this is a second tooth, just as in *Ancistrona*, continuous with the dorsal surface. This, however, instead of being regularly rounded is in *Læmobothrium* very wide, especially at the base, and is of the form of a truncated cone. The inner, or free end, is roughened by several short blunt cusps. This tooth, however, very evidently is the same thing as the posterior tooth of *Ancistrona;* the positions on the mandibles are identical.

From the inner posterior angle is a thick blunted process extending inward. It is rather short and terminally rounded. This process is present also in *Ancistrona gigas*. The outer posterior angle is truncated, and at its inner corner, projecting from the ventral surface, is an articulating condyle. This is some distance from the outer corner, and to the latter is attached the extensor muscle. The condyle projects backward and a little outward, and fits into a socket of the head. Dorsal to this on the head

is a condyle which articulates with a facet on the dorsal side of the mandible. This facet is more external than the condyle of the mandible, and is also farther forward. In all these points the mandible is extremely similar to the corresponding one of *Ancistrona*. The retractor muscle is attached directly near the inner posterior angle.

The left mandible is in general similar to the right, and agrees with the corresponding mandible of *Ancistrona* in the same way as the right one does, although the two are rather less alike than those of *Ancistrona gigas*.

The posterior tooth of the left mandible is continuous from the dorsal surface, but is very small compared with the anterior one, and is sharp-pointed compared with the corresponding tooth on the right side. The anterior tooth is much the same as that on the right side, or is perhaps a little smaller. Back of it is a depression on the inner part of the ventral surface; this is bounded behind by an elevation which is continuous inwardly as a slender projection from the ventral surface, just as in the case of *Ancistrona gigas*. This process is thick at its base but tapers distally to the rounded termination. Its anterior border is convex, but on the distal half of the posterior margin is a rather deep rounded concavity. To the outer

The Mouth-Parts of Eurymetopus taurus.

(Plate lxii, figs. 1–8.)

There are many striking differences between the mouth-parts of this form and those of either *Ancistrona* or *Læmobothrium*. The dissimilarity is most noticeable in the labiums. *Ancistrona* and *Læmobothrium* both belong to the suborder Amblycera, while *Eurymetopus* and the next form to be described, *Goniodes*, belong to the suborder Ischnocera, and the differences presented by these four genera are typical for the two groups.

In *Eurymetopus taurus* the *labium* (plate lxii, figs. 1 and 6) is reduced in size, and very much crowded back on the posterior aspect of the head. Instead of covering over the mandibles ventrally, it leaves them entirely exposed, its anterior border reaching only about as far forward as their posterior articulations.

On the posterior half of the median ventral surface of the head is a large unchitinized space. This is bounded laterally by the temples, posteriorly by a narrow, gular sclerite, presenting an obtusely angulated, convex, anterior border, and anteriorly in appearance by the mandibles, although it is really not bounded at all in front. The area is somewhat heart-shaped, having the apex forward, for the boundaries formed by the temples are convergent forward.

The membranous labium stretches across the posterior half of this space, while the part in front of the labium forms the mouth-opening. The labium is composed of the full number of sclerites, and of these the submentum is the largest. It is much wider than long; is unchitinized and membranous, and is attached all around, except in front, to the edges of the space just described. Its lateral edges are convex and rounded, while the posterior border is angularly emarginated to receive the convex

margin of the gula. Its posterior angles are much rounded. Anteriorly it presents a concave border of which the lateral portions are free, but the median part bears the mentum. The submentum, on account of its anterior and posterior concavities, is much constricted in the middle.

The mentum is a comparatively narrow, tranversely elongated, unchitinized sclerite, attached posteriorly to the submentum, but having its lateral borders free. The anterior outer angles are rounded. The median portion of the anterior border bears the glossæ and paraglossæ. These are not separated by any suture from the mentum, and hence there is no distinct ligular sclerite. The glossæ are two small oval lobes situated on each side of the median line and close to each other, being only slightly separated. Each bears four or five large, strong hairs situated on small basal segments. External to each glossa is a rather deep fossa in the mentum. In these fossæ are situated the paraglossæ. These are cylindrical structures having the outer ends somewhat enlarged, and bearing six or seven large, strong, two-jointed hairs like those on the glossæ. The paraglossæ are rather strongly chitinized compared with the rest of the labium;

The *maxillæ* (plate lxii, fig. 4) are simple, fleshy, unchitinized lobes attached to the lateral parts of the mouth-cavity, back of the mandibles. They show no indication of division into different sclerites. Near their bases they are somewhat thickened; the distal ends are weak and almost membranous, in mounted specimens they generally appear twisted and distorted. On account of the position of the labium the maxillæ are mostly exposed, only the bases being concealed. Each projects forward and inward.

The *mandibles* (plate lxii, figs 1 and 5) present a very strange appearance, both on account of their shape and their position. They are large, heavy, and strongly chitinized, and very remarkably different from those of *Ancistrona* and *Læmobothrium* in the way they are attached to the head. In these two genera the mandibles lie in a plane parallel to the head, and move in this plane. In order that this may be so, their articulating surfaces are in the same or nearly the same dorso-ventral line. In *Eurymetopus taurus* there are two articulating surfaces as before, but the mandibles move in a plane which forms a large angle with the horizontal plane of the head. To accommodate this action the articulating surfaces lie one in front of the other. The plane of the mandible is, however, not at right angles to that of the head, and consequently the anterior articulation is a little dorsal to the posterior one. In the next form to be described, *Goniodes cervinicornis*, the mandibles are almost or quite at right angles to the head, thus presenting an advance in this respect beyond *Eurymetopus*. In either of these two genera the mandibles may be regarded as being the same, typically, as in the Amblycera; but that each has been revolved on an axis passing from the tip of the inner basal process to the articulating condyle,

until the anterior margin becomes the ventral margin. All the apparent differences may be reconciled by this view. In accordance with it the articulating surfaces lie as they should. Further, the mandibles being as in the other genera, two-toothed, the posterior rounded tooth of *Ancistrona*, arising from the inner dorsal margin, lies in this form on the anterior inner aspect, in front of, and dorsal to the larger tooth.

The left mandible has also the long slender process at the inner part of the base, as in *Ancistrona* and *Læmobothrium;* but, as would be expected, this arises from the dorsal aspect of the base. Since, however, in *Eurymetopus* it is very long and slender, it is bent backwards so as to lie parallel with the head. In *Goniodes cervinicornis*, however, it is shorter and projects inwardly.

The mandibles of *Eurymetopus taurus* are entirely exposed on the ventral surface of the head, not even their bases being covered by the labium. They are thick and have a clumsy appearance. The anterior articulating surface is a large facet situated at the anterior outer angle of the mandibles, on the dorsal surface. A rounded process projects over it from below. The posterior outer part of the mandible, bearing the condyle by which it is

tooth is shorter than the other, not so thick, and has a rounded termination. Its anterior border is just visible from the ventral side of the head, in front of that of the ventral tooth.

In *Eurymetopus* and in a large number of other genera of the Mallophaga there occurs a very curious pharyngeal sclerite with accessory structures, within the cavity of the head. It is not intended here to explain the origin or function of these, but merely to describe them.

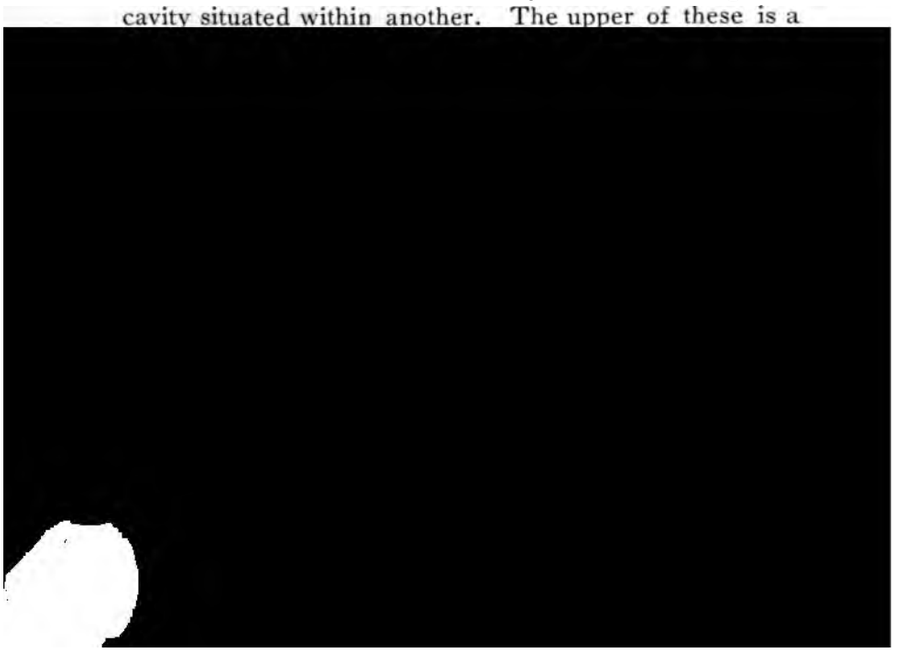
The sclerite referred to is a thick, strongly chitinous structure situated in the ventral wall of the pharynx, and is probably a greatly modified portion of its chitinous cuticle. In a mounted specimen it is plainly visible through the head from either the upper or the lower side. Lying ventral to the sclerite are two structures which appear to be glands, and are connected with it by a duct. All three of these structures are visible through the head of cleared and mounted specimens, and lie just back of the anterior edge of the labium.

This *œsophageal sclerite* (plate lxii, figs. 1, 2, 3 and 7) is in general form cup-shaped, having the hollow part turned upward and forming a depression in the floor of the pharynx, since its interior is simply a part of the pharyngeal cavity. The ventral surface is very convex, being almost hemispherical. The anterior end is truncated, but from each of the two anterior angles thus formed there projects forward, outward, and dorsally, a large dorso-ventro-laterally flattened process, which lies in the lateral wall of the pharynx, the two partly surrounding the cavity of the latter. Each of these processes is expanded distally, and sends a long, rounded, and bluntly terminated projection backwards. These latter processes lie parallel with and a little external to the lateral margins of the body of the sclerite, their outer edges being visible from

the ventral side. Posteriorly there is a thick, rounded, median process which projects backward from near the dorsal edge of the sclerite, but still some distance below it, so that it is free from and not imbedded within the wall of the pharynx.

The sclerite, viewed ventrally, is somewhat shield-shaped in profile. The body is almost semicircular, with a small segment taken off in front by the anterior truncation referred to. Posteriorly there projects the median rounded process, and anteriorly on each side the anterior lateral processes. The latter give to the anterior profile an emarginated appearance. In the middle there is a longitudinal light colored area, due to the cavity on the dorsal side, the floor of which, being thinner than the other parts, transmits more light in mounted specimens. This area is expanded near the front, contracted from side to side posteriorly, and rounded before and behind. Along the median line there is a narrow linear area still lighter in color, due to a groove in the bottom of the dorsal hollow.

The dorsal surface of the sclerite is, as already described, excavated, and is doubly so, there being one cavity situated within another. The upper of these is a



noticeable on the sclerite when viewed from the ventral side by means of transmitted light. It is much longer than broad, and its widest diameter is in front of the middle. Anterior to this the dorsal edges form a rounded outline, but back of it they are a little concave and approach each other posteriorly. The posterior end is narrow and rounded. The walls of the cavity are concave, steeper in front and behind than elsewhere. The bottom slopes a little downward posteriorly, so that the cavity is deepest behind. Running longitudinally along the bottom is a narrow groove; this begins in front at the bottom of the anterior wall, and extends backwards from an aperture which is the opening of a duct into the sclerite.

To the sides of the shallower cavity are attached two large, laterally compressed, chitinous, pyramidal structures, one on each side, whose ventral surfaces are not quite so divergent as the walls of the cavity to which they are attached, or perhaps better, from which they arise. The bases of these are very wide, but dorsally they become rapidly narrowed and pass upwards around the œsophagus, or pharynx, as two chitinous bands. Their dorsal ends are attached by large muscles to the dorsal wall of the head.

The sclerite is about as wide as long, or sometimes a little longer. The dimensions of one specimen measured are as follows: Length of the body, .097 mm.; width, .108 mm.; length of posterior projections, .02 mm.; distance which anterior processes extend in front of anterior border of the main part or body, .0227 mm.

The gland-like structures (plate lxii, figs. 1, 7 and 8) before referred to, lie ventral to the sclerite, and the inner halves overlap its outer portions (fig. 7). Their outer edges also lie a little dorsal to their inner edges, so that they ex-

tend slightly around the outer margins of the sclerite. Each is an oval structure, having the long diameter extending from within outwards and backwards. The ventral surface is convex, and the dorsal surface concave, while the whole is very much flattened dorsoventrally. Each is invested in a thin chitinous envelope, and is seated upon the ventral anterior surface of a chitinous pedicle which is expanded where it receives the gland. The expanded portion of the pedicle is thin and convex ventrally, so as to fit the dorsal concavity of the gland; and the middle of its shallow dorsal concavity lies below and external to the outer edge of the sclerite. Back of the glands the pedicle extends backward and outward, but not so much in the latter direction as the long axis of the gland, so that the two form an obtuse angle inwardly. The part of the pedicle not having the gland attached is about as long as the other part, and it is somewhat more chitinous. It tapers backward, but ends in a foot-shaped expansion, with the toe turned outward. To this is attached a large, wide muscle which extends backward to its origin in the posterior part of the head cavity. At the posterior end of the gland, on the ventral surface, a duct arises which passes forward attached closely to

soldered to the glands, but in addition to this there is an outer portion composed of a series of closely set, chitinous rings, surrounding the tube. Each gland is about as wide as the sclerite, but is considerably longer.

The Mouth-Parts of Goniodes cervinicornis.

(Plate lxi, figs. 6–9.)

In *Goniodes cervinicornis* as in *Eurymetopus taurus* the mouth-parts are crowded far back on the ventral surface of the head, so that the bases of the mandibles lie posterior to the bases of the antennæ, instead of in front of them, as in most of the Amblycera.

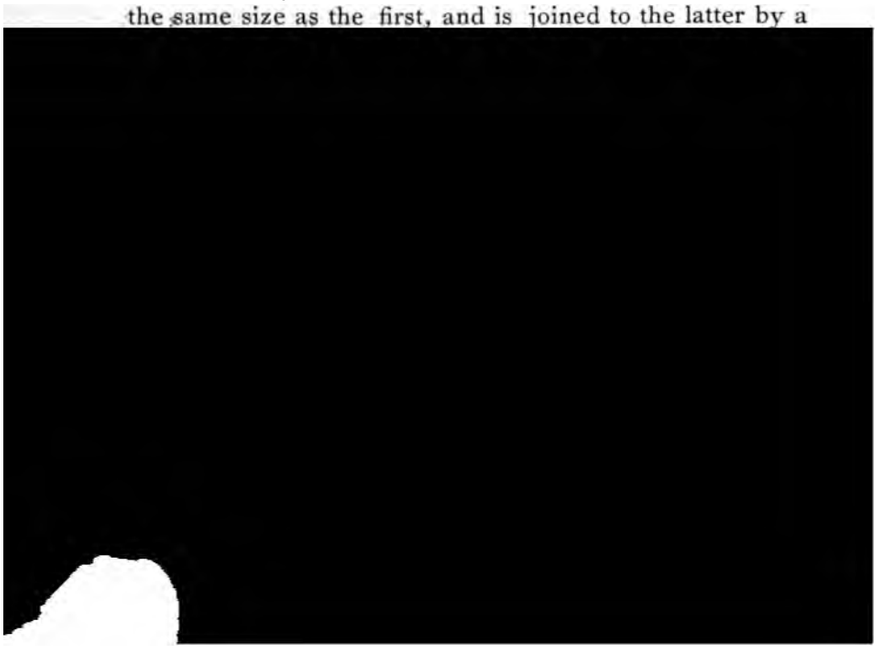
The *labium* (plate lxi, fig. 7) has its anterior border between the bases of the antennæ, and hence it is very much shortened from before, back. The part which seems to have suffered most in the crowding is the mentum. It is narrow and not distinctly separated from the ligula, and is farther aborted by having lost its palpi. This condition is true not only in the genera *Eurymetopus* and *Goniodes*, but holds for the Ischnocera generally.

The main sclerite of the labium is the submentum. This is a large unchitinized sclerite, having a straight posterior border and a very concave anterior border. The sides present an obtusely angulated, convex margin. The anterior border is so deeply and roundly concave that it forms almost a semicircle. Its most posterior part is as far back as the middle of the lateral edge of the sclerite; hence there is a narrow portion projecting forward on each side. These reach as far anteriorly as a line joining the middle of the bases of the antennæ. The rest of the labium is situated in the concavity of the anterior part of the submentum. It consists of the fused mentum and ligula (plate lxi, fig. 7), and is divided into three lobes, two lateral and one median. The median lobe is almost

square, and has its anterior border slightly emarginated and the anterior outer angles projecting a little. This lobe is thus composed of the glossæ, which are separated only by the anterior emargination. The lateral lobes are rounded and bear the cylindrical paraglossæ. These are almost identical with the paraglossæ of *Eurymetopus*, being also more strongly chitinized than the rest of the labium, and bearing on their slightly expanded ends a few strong hairs with basal segments. They project ventrally and a little inward and forward, the distal ends being nearly always seen first on focussing down on a specimen toward the ventral surface.

Back of the submentum is a narrow gular sclerite continuous across the median line from the lateral portions of the head.

The *maxillæ* (plate lxi, fig. 6) are soft unchitinized structures lying within the mouth cavity. Each is divided into three lobes: one basal, another terminal, and the other between these two. By the basal lobe the maxilla is attached to the wall of the head, and it projects inward into the mouth cavity. It is irregularly round in outline and is entirely unchitinized. The middle lobe is of about the same size as the first, and is joined to the latter by a



plane almost perpendicular to it, but inclined very slightly forward; their tips meet in the middle line, so that they form an arch over or ventral to the mouth-opening. The anterior lateral projections of the submentum extend forward beyond the bases of the mandibles, and the glossæ and paraglossæ lie just back of their posterior margins. Hence the mentum, ligula and mandibles are all enclosed in the anterior semicircular border of the submentum.

The right mandible is triangular in dorsoventral section. The ventral part is thickened and prolonged inwardly at the inner ventral angle, forming two large thick, bluntly pointed teeth. These are separated from each other only by a slight emargination, and they lie one anterior to the other. The anterior of these probably corresponds with the dorsal tooth of the mandible of *Ancistrona gigas;* if so, it has changed its position so that its tip is as far forward as that of the posterior tooth, and these two have become fused into a single process. The anterior tooth, however, does not reach quite as far inwardly as the posterior one, and is also a little dorsal to it. Both of these positions correspond with those of the dorsal tooth of *Ancistrona gigas* and *Læmobothrium.* A large thick process projects inwardly from the inner dorsal angle. This very evidently corresponds with the extremely similar process from the posterior inner angle of the right mandible of *Ancistrona*, and with the less similar but certainly homologous process of *Læmobothrium.* This projection is the inner end of a posterior thickening of the mandible which bears near the outer angle of the base, on the posterior aspect, the articulating condyle. This projects dorsally, and fits into a socket on the ventral side of the head. On the anterior side of the mandible, somewhat more ventral than the condyle, is the articulating facet into which fits a condyle from the ventral surface

of the head. The facet presents the peculiarity of having no inner wall, and is separated only by a constriction from a large cavity in the anterior thickened part of the mandible. This cavity is elongated in a line extending from the facet to the two teeth of the mandible. The posterior wall of the cavity is very thin.

Attached to the dorsal border of the inner angle of the mandible is a large thin chitinous plate (plate lxi, fig. 9, *ch. pls.*). This plate is thickened proximally and appears here darker than the rest. This part is also narrow, but distally the plate expands and becomes very thin and transparent. The distal border is not definite, being very thin and generally irregularly broken away. Attached to this plate are the retractor muscles of the mandible. The plate and muscles extend dorsally and very slightly backward from the mandible, since they lie in the same plane as the latter. From the outer posterior angle of the mandible there extends dorsally and outward a slender, very thin, chitinous structure, which bears the extensor muscles of the mandible. These two sets of muscles are attached to the dorsal wall of the head. The left mandible is very similar to the right. The two teeth are more separated and are sharper. The process projecting

of *Eurymetopus taurus*. Besides these, however, there are two forked rods projecting into the mouth cavity, as in the case of *Ancistrona gigas*. These rods are extremely slender and difficult to dissect, but they lie just dorsal to the labium, and pass forward beneath the œsophagus, and ventral to the glands connected with the pharyngeal sclerite. Only the bifid tips project into the mouth. Near the anterior end muscle fibres are inserted which pass forward and downward to their origin on the dorsal side of the labium. These evidently serve to draw the rods forward. Those of *Ancistrona gigas*, which is enormous amongst Mallophaga, are almost invisible to the naked eye, being weakly chitinized, and only .5 mm. long by .05 broad at the widest place. Only one specimen of the species of *Læmobothrium* described was had for dissection, and the rods may have been present but overlooked. Also it cannot be stated that they do not occur in *Eurymetopus taurus*. It is to be noticed that the genera *Ancistrona* and *Goniodes* belong to the two different subgroups of the Mallophaga.

Resumé.

From these detailed accounts of the mouth-parts of four genera of Mallophaga, equally divided between the two principal groups of the order, we may confidently make a summary statement of the condition of the mouth structures of the Mallophaga.

The mouth-parts are confined to the ventral aspect of the much flattened head, the frontal margin of the head being formed by the greatly developed clypeus. The labrum is the foremost of these ventrally located mouth structures, and is well developed, serving for prehension, and in some cases as a disk or platelike sucker for attach-

ment. It appears as a simple flap lying in front of, and, when at rest, partly over the mandibles.

The *mandibles* are large and strong, usually roughly triangular in profile, with at least one projecting sharp-pointed tooth, and one or two blunter teeth. Each mandible presents a characteristic facet and a condyle which articulate with two strong chitinous rami attached one to the ventral wall of the head and one to the dorsal wall. One ramus articulates by a condyle with the facet of the mandible, and the other by a facet with the condyle of the mandible. The mandibular muscles are exceptionally large. In the two genera of the suborder Amblycera, the mandibles lie in a plane parallel to the horizontal plane of the head, while in the two genera of the suborder Ischnocera, the mandibles project in a plane nearly or quite at right angles with the horizontal plane of the head. This remarkable difference is probably characteristic of the two main groups of the order. The mandibles, though varying somewhat in shape in the two groups, are essentially similar in general character and in manner of articulation; the articulations in the Amblycera lie in a dorso-ventral line, while in the Ischnocera they lie in a cephalo-caudal line; if, however, the Amblycerous mandibles be

tally, and bears few to many small teeth. Sometimes the distal part of the maxilla is two-parted and these two parts may represent the galea and lacinia of the typical maxilla of the orthopterous type. The maxillary palpi are completely lost, there being no indication of them on any of the maxillæ examined.

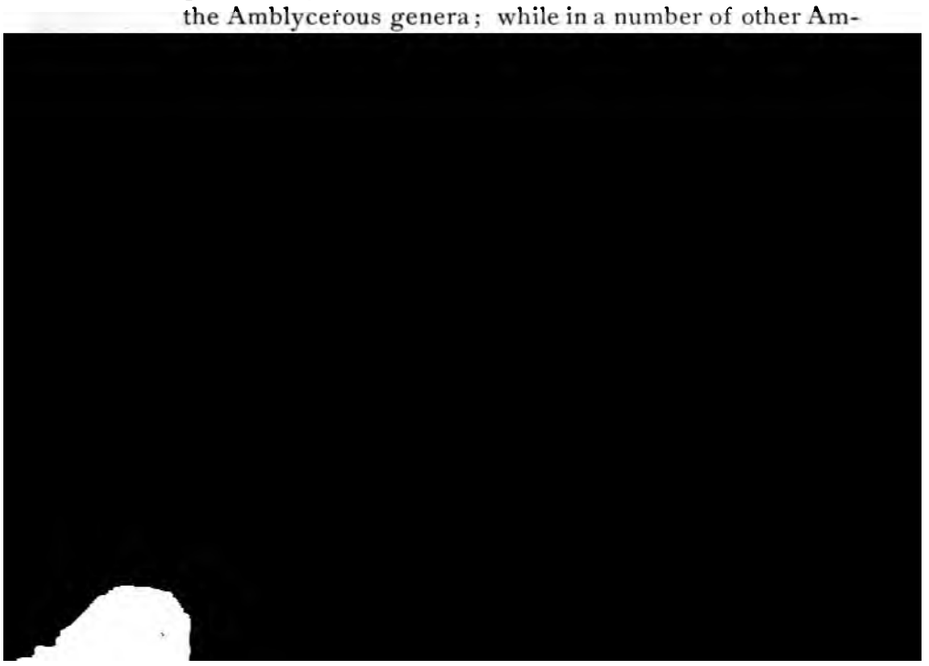
The *labium* (see, in addition to figures previously referred to, plate lxiii, figs. 1, 2, 3, 5, and 6) shows some considerable variation in the two suborders. In the Amblycera it is a larger and more complete structure than in the Ischnocera. A distinct submentum, mentum, and ligula are always present, the ligula consisting of the two terminal lobes, glossa, and paraglossa of each constituent half of the labium, united at their bases. With the Amblycera conspicuous 4-segmented palpi rising from a basal segment-like palpifer are always present; while with the Ischnocera palpi are wanting. The ventral or other surface of the labium is in some forms (see *Ancistrona gigas*) provided with strong backward-projecting, pointed, sometimes bipartite processes, as with *Ancistrona gigas*, *Menopon tridens*, *Menopon robustum*, and others. These processes must subserve some holding on or clasping function.

A hypopharynx of elaborate structure was observed in *Ancistrona gigas*, but not in the other species dissected. Grosse refers to a delicate membranous fold of the ventral wall of the mouth, which in some forms projects beyond the ligula as the hypopharynx.

The "forks" observed in *Ancistrona* and in *Goniodes*—genera representing both suborders of Mallophaga—because of their similarity to the familiar "forks" of the Psocidæ are of exceptional interest, and have not heretofore been referred to in the literature of the Mallophagous mouth-parts. Most plainly discernible in *Ancistrona*,

they are very small, fine, chitinous rods lying inside of the mouth above the labium, whose posterior ends are attached to the ventral wall of the head by muscles and whose anterior ends are shortly forked or bifurcated, and project through the lining of the ventral wall of the mouth, thus lying free and uncovered in the mouth cavity. Although not observed in the other two genera of Mallophaga dissected, it is not at all certain that they are not present, their extreme minuteness and delicacy making their discovery a matter of difficulty.

The œsophageal sclerite and glands are also structures of extreme interest from their probable identity with similar structures in the Psocidæ. They do not appear to be present in all the Mallophagous genera; but I have observed them in a majority of the genera, viz., *Docophorus*, *Nirmus*, *Lipeurus*, *Eurymetopus*, *Goniodes*, *Goniocotes*, *Giebelia*, *Oncophorus*, *Trichodectes*, *Colpocephalum*, and *Menopon;* also in Piaget's figures of *Akidoproctus* the sclerite is indicated. I have found the sclerite and glands absent in *Ancistrona*, *Nitzschia*, *Trinoton*, *Læmobothrium*, and *Physostomum*. It will be noted that the sclerite and glands are present in all Ischnocera examined, and in two of the Amblycerous genera; while in a number of other Am-



around it, and attach by their ends to the dorsal wall of the head. Opening into the median groove from its ventral side is a small duct, which, followed to its source, is seen to come from the union of a pair of ducts, each one of which comes from an oval gland lying ventral to the sclerite, and fitting into a concavity on the anterior end of a weakly chitinized, pedicle-like structure, which projects backward and is attached by a foot-shaped expansion to a large, strong muscle. This sclerite, which I call the "œsophageal sclerite," shows distinctly through the dorsal and ventral walls of the head, so that it is usually a conspicuous feature in the markings of the head, appearing as a V- or U-shaped mark with thickened sides (see this mark in the various figures illustrating the systematic part of this paper). It is this sclerite which has been called in the monographs of the European writers the labium, and in my "New Mallophaga, I," I have constantly referred to it by the same name. It is this sclerite, too, undoubtedly, which is the subject of Melnikoff's references, in his embryological memoir, to a sucking apparatus. Grosse refers to this sclerite as the Schlundskelett, and describes it, briefly, in *Tetraopthalmus chilensis (= Menopon titan)* and *Goniodes dissimilis*. He found also a chitin thickening of the dorsal wall of the pharynx, immediately above the ventral sclerite.

The mouth-parts of the Mallophaga are distinctly fitted for biting; there are no mouth structures which lend any probability to the old theory that the Mallophaga took food by sucking. The peculiar pharyngeal structures, while not yet understood in point of function, are not at all of a character to suggest anything like a sucking function. Grosse comes to no definite conclusion regarding the function of these œsophageal sclerites, but he says: "Ich schliesse aus seinem Bau, dass derselbe nicht zum Saugen,

waders are forgetting and are learning to integument-penetrating feeders. All of my observation, as far as it goes, tends to substantiate the belief, based on the structure of the mouth-parts, that the Mallophaga take all their food by biting. I have seen them biting off and eating the ends of feathers, and the crop content, which shows plainly through the skin in many specimens, is always composed of tiny bits of feathers.

COMPARISON WITH THE MOUTH-PARTS OF OTHER INSECTS.

It should be of interest now to compare the mouth-parts of Mallophaga with the mouth-parts of those insects which have been placed in recent classifications nearest to the Mallophaga. Since the breaking down of Erichson's catch-all order, Pseudo-Neuroptera, the association of the Mallophaga, Termitidæ, Perlidæ, Embiidæ, and Psocidæ, into the order Platyptera has been, until very recently, the usually accepted interpretation of the place of the Mallophaga among insects. The most recent classifications assign to the Perlidæ, Termites and Mallophaga ordinal rank. Undoubtedly the Mallophaga are to find their affinities among the members of the group Platyptera, and it is, therefore, with the mouth-parts of these insects

well developed, with distinct cardo, stipes, palpifer, 4-segmented palpus, and both terminal lobes, the lacinia sharply two-pointed, and the outer hoodlike galea fleshy; labium (plate lxiv, fig. 1) with elongate elliptical submentum, mentum, 3-segmented palpi, and ligula showing in each half both glossa and paraglossa. The Termite species whose mouth-parts I figure to illustrate the general character of the Termite mouth structures is *Termopsis angusticollis*, a large form common in California.

The Perlidæ, as the Termitidæ, present the generalized biting type. In the adult Perlids, to be sure, the mouth-parts seem to be hardly functional, being reduced to a semimembranous condition, with some correlated changes in form. In the nymphs, however, the usual Orthopterous form is shown. I have figured the mouth structures of a nymph of *Perla* (plate lxiv, figs. 3 and 4). The mandibles of the adult are very small and but slightly chitinized.

The Mouth-Parts of the Psocidæ.

(Plate lxiv, figs. 5-11.)

The mouth-parts of the Psocidæ present a modified or specialized type of biting mouth-parts. They have been the subject of some study and some dispute, and perhaps are not yet fully understood. An especially confusing feature is the presence of the "forks," and characteristic and little understood organs are the paired "lingual glands" lying "within the tongue." The best paper on the Psocid mouth-parts is one by Edward Burgess,* in which special attention is given the forks and the lingual glands.

*Burgess, Edward. The Anatomy of the Head, and the Structure of the Maxillæ in the Psocidæ. Proc. Bost. Soc. Nat. Hist., 1878, vol. xix, p. 291, pl. viii.

In the two subfamilies of the Psocidæ, the winged Psocinæ and the degraded, wingless Atropinæ, the attitude of the head varies from a hanging or vertical position in the Psocinæ to the nearly horizontal position of *Atropos*. With the change from vertical to horizontal position there goes a marked flattening of the head, so that the head of *Atropos* (plate lxiv, figs. 5 and 7) in its horizontally projected attitude, its flattened condition, and the limiting of the mouth-parts to the ventral aspect of the head, shows both in its relation to the body of the insect and in its own shape and condition, a great similarity to the horizontal, flattened head of the Mallophaga. The clypeus of *Atropos* is large, projecting far forward, and, as in the Mallophaga, forms the frontal margin of the head, the labrum lying on the ventral aspect of the head (plate lxiv, fig. 5). All the mouth-parts lie on the ventral aspect of the head (plate lxiv, fig. 5) The mandibles (plate lxiv, figs. 5, 6, and 8) are strong, toothed, and present distinct protruding condyles wholly similar in position and general character to those of the Mallophaga (see plates lx–lxiii). The maxillæ (plate lxiv, fig. 5) I do not understand, but there are no conspicuous terminal free lobes; there is a large basal part, and artic-

Burgess has studied the mouth-parts of *Psocus* in detail, and for the sake of his accounts of the forks, and of the œsophageal sclerite and lingual glands, those structures so characteristic of the Psocidæ, and probably—certainly, in the case of œsophageal sclerite and lingual glands—quite as characteristic of the Mallophaga, I quote from his paper referred to, as follows:—

"The maxilla in *Psocus* is hinged to the head by a small obscure piece which is immovably soldered to a larger joint. The first piece represents, probably, the cardo of a typical maxilla (plate lxiv, fig. 10, *c)* and the second the stipes *(p)*. The stipes bears outwardly the 4-jointed maxillary palpus, while inwardly is hinged a thick, fleshy lobe, broad at the base, but soon contracting and curving inward. The tip is flat and has a broad, oval outline on the inside, and is strengthened by several imbedded chitinous rods and other pieces. This lobe, by its position and shape, is doubtless homologous with the ordinary outer maxillary lobe, or galea, of the other Orthoptera. Behind the lobe, that is between it and the tongue, lies the 'horny process' of Westwood's description, or 'fork,' as I shall call it. This is a slender, more or less curved chitinous rod with a forked bifid tip, and two or three times as long as the outer lobe (plate lxiv, figs. 9 and 10, *f)*. The distal portion of the fork, about one-third or less of its length, projects through the lining membrane of the mouth. At this point the fork is stoutest, and from it, it tapers to either end, the outer portion being stouter than the inner. The membrane where it is united with the fork is delicate and elastic, thus permitting the fork to be projected forward or drawn back at will. Within the head the fork is held in position by muscles inserted on its base, which unite it with the lobe and stipes of the maxilla, and by a ligament which runs

backward to the top of the head. Of these muscles one is inserted on the base of the lobe; two others are inserted apparently within the stipes; by their contraction the fork is thrown forward out of the mouth, or moved about. The backward-running cord, which is double, is apparently neither muscular nor the tendon of a muscle, but simply an elastic ligament to draw the fork back, and probably the membrane pierced by the fork aids in the same movement. The fork is still further held in place by the flexor muscles of the stipes and lobe which pass behind it and serve to bind it down against the lobe.

"In the maxilla we have recognized cardo, stipes, and outer lobe, and one naturally asks if the fork is the homologue of the inner lobe of the typical maxilla, or an independent organ. At present I must incline to the latter view, although some may regard the absence of anything else to represent the inner lobe as sufficient evidence of their homology. But there is no articulation of any kind between the fork and the outer lobe, and the peculiarity of the muscular connections seem rather to favor the idea that the fork may represent an independent organ.

"The maxillæ and mandibles occupy the lower half of

presently to be described. Just below this bone there is a double elevated ridge covered with short hairs (plate lxiv, fig. 11).

"The lower lip (plate lxiv, fig. 10) is composed of an oblong mentum *(m)* bearing a larger labium *(lb)* narrowed at the base, then expanding so as to have a bisinuate, almost S-shaped lateral outline; the lower edge bears two short, broad lobes, and two stumpy, one-jointed * palpi *(l.p.)*. The labium in profile (plate lxiv, fig. 9) is very thick, and the lower edge is divided into two narrow laminæ, while still a third lamina, well separated from the first two, forms the tongue (plate lxiv, fig. 9, *t*). Within the tongue lie a pair of peculiar organs which may be called the lingual glands (plate lxiv, figs. 9 and 10, *l.g.*); these can be seen through the semitransparent mentum and labium, as in plate lxiv, fig. 10, offering an irregular, obovate outline. A short duct from the lower end of each gland leads into a common duct *(l.d.)* which opens in the œsophageal bone as already described.

"The ducts curve over the lower end of the glands and run up their posterior surface, to which they are soldered nearly to the top. The line of the ducts, together with the lateral outlines, give the glands a three-cornered shape, somewhat like that of a butternut. A little triangular cap fits on the summit of each gland, and on it is inserted a suspensory muscle, the upper end of which is attached to the cranium (plate lxiv, figs. 9 and 10, *g.m.*). The specimens at my command have not been fresh enough to study the histology of these organs, but they seem to be composed of an outer sack, with a thin tough wall which

"*With Westwood I regard these pieces as true palpi, and not as a second pair of labial lobes."

is light yellow and has a slightly roughened or granular surface. The interior is filled with cells, and perhaps may be glandular. The excretory ducts are thick-walled and strengthened by circular threads, as is often the case with the salivary ducts of *insects."

Scudder in his note "on the structure of the head of *Atropos*," in "Psyche," 1877, vol. ii, p. 49, gives a different account of the fork, saying that "instead of forming a single, simple, rodlike process, this inner lobe [=fork] is three or four times as long as has been presumed, and is two-jointed, the apical point lying, when the organ is at rest, beside the basal joint, which is attached to the maxilla at the extreme base of the latter; the basal joint is directed backward and lies almost directly beneath the basal portion of the apical joint." Mr. Scudder believes that the fork is without any doubt homologous with the customary inner lobe, or lacinia of the maxilla. As will be noted in the foregoing quotation from Burgess, this author believes Scudder's account of the fork as a two-segmented organ to be erroneous, and he inclines to the belief that the fork is an independent organ, and not a part of the maxilla.

type of mouth-parts, and offer besides this no special resemblances to the Mallophagous condition. There is no indication in the mouth-parts of the Termitidæ, wingless and specialized though the Termites are, of modifications in the direction of the Mallophagous mouth-parts. In fact, considering the food habits of the Termites and the specialization (by degradation) of their bodies, the mouth-parts show a surprising faithfulness to the simple usual Orthopterous type.

It is in the comparison of the Mallophagous mouth-parts with those of the Psocidæ that such interesting resemblances and parallel or homologous structures appear as to give basis for a belief in the near relationship of the two groups.

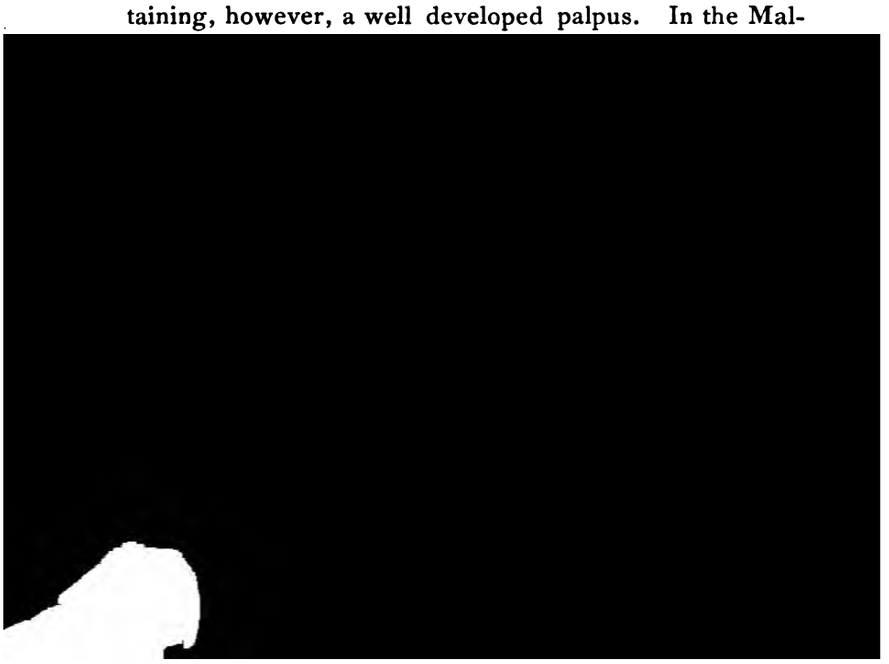
The comparison of the mouth-parts of the Mallophaga and the Psocidæ is not made here for the first time. In 1887 Dr. A. S. Packard read a paper before the American Philosophical Society entitled: "On the Systematic Position of the Mallophaga," in which he makes such a comparison. Dr. Packard based his paper on the studies of Melnikow and Grosse on the Mallophaga, and of Burgess on the Psocidæ, and on his (Packard's) own studies. In this paper attention is called to the general similarities shown in the two groups in the position of the mouth structures, due to the great development of the clypeus, in the shape of the mandibles, in the reduction of the maxillæ, etc.

In the light, however, of the preceding detailed accounts of the mouth-parts of *Ancistrona*, *Læmobothrium*, *Eurymetopus* and *Goniodes* (Mallophaga), with their detailed descriptions of the œsophageal sclerites and glands, and the "forks" of *Ancistrona* and *Goniodes*, the comparison of the Mallophagous and Psocid mouth structures may profitably be carried farther than has yet been done.

The flattening of the head, with the great development of the clypeus, and the restriction of the mouth-parts to the ventral aspect of the head, so characteristic of the Mallophaga, is quite as characteristic of *Atropos*, the wingless, degraded Psocid. Among the winged Psocidæ the head hangs vertically, and although there is a similar great development of clypeus, there is less flattening of the head and less general resemblance. The peculiar condition of the labrum in the Mallophaga, lying as it does on the ventral aspect of the produced clypeus, finds an identical repetition in *Atropos;* a point which Packard seems to have overlooked when he says that the Mallophaga differ from the Psocids in having the labrum covered by the clypeus. In the winged Psocidæ the head is not horizontal as with the Mallophaga and *Atropos*, and the labrum is attached to the ventral margin of the clypeus.

The mandibles of *Atropos* present a really striking similarity with those of the Amblycerous Mallophaga. The details of teeth, condyles, facets, and musculation are extraordinarily alike.

The maxillæ of the Psocidæ are greatly reduced, retaining, however, a well developed palpus. In the Mal-



glands of the Mallophaga, with the characteristic "œsophageal bone" and glands of the Psocidæ. The comparison of these structures in the two groups reveals an agreement in position and character so nearly identical as to preclude any supposition of independent origin. Also, there is to be noted the presence, in certain genera of the Mallophaga, of a pair of "forks," very much reduced in size, and not yet well understood. These forks seem very like the familiar and characteristic Psocid forks, so far apparently found among no other insects.

It is not intended to discuss here, at all, the probable relationship of the Psocidæ and Mallophaga, simply to point out the peculiar and interesting similarity of mouth structures, as so far brought out in the study of the groups. It is of interest to note in this connection the rather similar food habits of the two groups, the Psocidæ feeding on dry, dead organic matter, such as wood and paper, dried insects, and dried bird and mammal skins; and the Mallophaga feeding on the dry, dead dermal scales, hairs, and feathers of mammals and birds. I have found *Atropos* not infrequently in the nests of birds.

DESCRIPTIONS OF NEW SPECIES.

Docophorus.

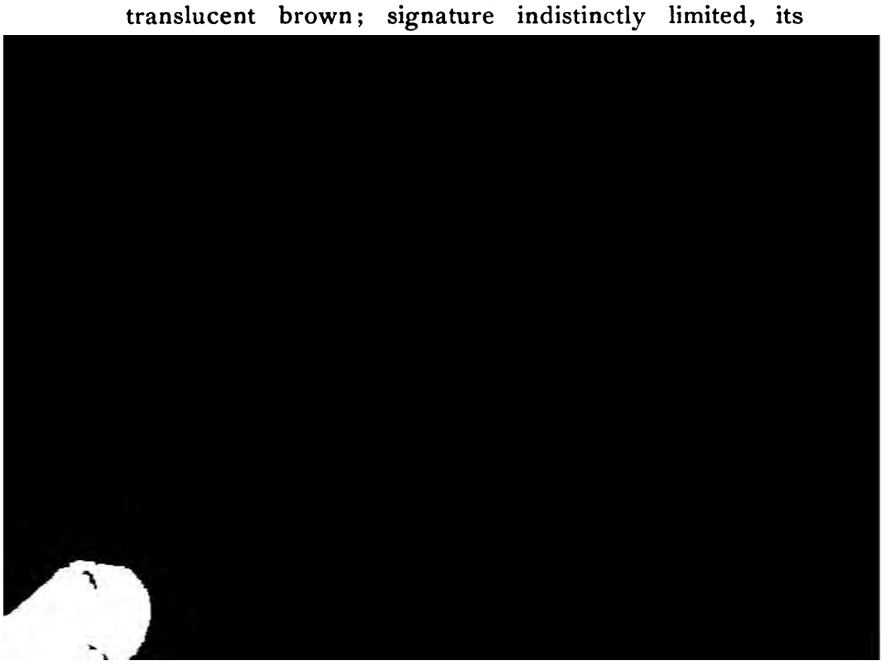
Docophorus taurocephalus n. sp. (Plate lxv, fig. 1.)

Two males and a female from an American Rough-legged Hawk, *Archibuteo lagopus sancti-johannis* (Lawrence, Kansas). A member of the group dilatatoclypeati, found on eagles and hawks and characterized by the more or less prominent, uncolored frontal expansion of the clypeus. The new form resembles Nitzsch's *gonorhynchus* (Giebel, Insecta Epizoa, p. 70), from *Astur*

nisus, in the emargination of the clypeus, and it shows, also, what Piaget affirms to be merely an individual character, the effacement of a distinctly limited signature, as spoken of by Nitsch. The new form is markedly larger than *gonorhynchus*, and the male has no transverse linear blotch on the last segment.

Description of male. Body, length 2.06 mm., width 1 mm.; strongly colored.

Head, length .78 mm., width .78 mm.; thus being very large in proportion to the size of the body; front with shallow emargination, the projecting lateral parts angulated; clypeus expanded laterally behind these frontal angles, and the uncolored expanded portion bearing two conspicuous, longish hairs; a short marginal hair just in front of the suture, and two longish hairs rising on dorsal surface and projecting beyond margin between suture and trabeculæ; trabeculæ broad, not reaching beyond end of segment 1 of antenna; eye projecting, pendulous, with angulated cornea, and bearing a hair; temporal margins flatly rounded and bearing four long hairs, and on occipital side of posterior angle a short hair; occipital margin nearly straight, bare; general color of head light translucent brown; signature indistinctly limited, its



obtusely angled posterior margin, bearing on the mesal third eight weak, non-pustulated hairs, and in the lateral angles two longer and stronger hairs; large, transverse, lateral blotches separated by a narrow, uncolored, mesal, linear space widening anteriorly; legs pale brown, with dark brown markings on dorsal margins of femora and tibiæ.

Abdomen broadly elliptical, short, segments projecting little or not at all at sides, and with two to three long hairs in posterior angles; a single transverse series of hairs on dorsal surface of each segment; lateral transverse blotches large, and with pointed inner ends; lateral bands darker, not distinctly limited; posterior margin of last segment flatly rounded, with numerous longish hairs which are confined to the lateral portions of the margin.

Female. Body, length 2.53 mm., width 1.04 mm.; head, length .87 mm., width .87 mm.; the lateral abdominal blotches much shorter, the hind body tapering posteriorly, and the ninth segment narrow, uncolored, tapering behind, and narrowly angularly emarginated so as to produce two short acute points.

Docophorus alienus n. sp. (Plate lxv, fig. 2.)

Found on a Yellow-shafted Flicker, *Colaptes auratus* (Lawrence, Kansas). This species does not resemble any of Nitzsch's or Piaget's *Docophori* taken from woodpeckers, but belongs to Piaget's group *latifrontes*, found on the cuckoos. The group is characterized, according to Piaget, by the width and emargination of the clypeus, and by the large size of the posterior legs. The clypeal characters are presented by this new form, but the posterior legs are not especially enlarged.

Description of the male. Body, length 1.62 mm., width 7 mm.; the only specimen is a recently moulted

one, so that the chitinization is incomplete, and the color is nearly lacking. If it were not for the well marked clypeal characters, which indicate its affinities unmistakably, I should not describe the specimen.

Head, length 56 mm., width 53 mm.; front broad, angularly emarginated; two submarginal hairs between the suture and the anterior angles of the clypeus, of which the hinder is much the longer; a short hair at the suture, and three short ones in front of the trabeculæ; the trabeculæ very long, reaching to end of segment 2 of antennæ; eye prominent, with a hair and black fleck; four longish hairs on temporal margin; occipital and antennal bands pale, but evidently to be well chitinized; signature broad, emarginate on anterior margin.

Prothorax short, with rounding angles, and with single hair in posterior angles; indications of strong, even, lateral bands. Metathorax obtusely angled on abdomen, with a series of pustulated hairs along posterior margin; indications of large lateral blotches. Legs concolorous with body.

Abdomen broadly elliptical, with long hairs in posterior angles of segments, and one transverse row of hairs across each segment; lateral transverse blotches are indicated,

temporal angles more convexly rounded; metathorax obtusely angled on abdomen, and with transverse blotch, with posterior margin not parallel with the posterior margin of the segment; thorax relatively broader than in *communis*. Measurements of male: Body, length 1.72 mm., width .75 mm.; head, length .59 mm., width .56 mm. Female: Body, length 2.12 mm., width .90 mm.; head, length .63 mm., width .63 mm.

Docophorus domesticus n. sp. (Plate lxv, fig. 4.)

Males, females, and young taken from the Purple Martin, *Progne subis* (Lawrence, Kansas). Most nearly like Nitzsch's *excisus* (Giebel, Insecta Epizoa, p. 88, pl. xi, figs. 1, 2, 3) found on *Hirundo urbica* and *Cypselus apus*, but markedly larger. Piaget calls *excisus* one of the smallest *Docophori* known, and gives the average length of the males as 1. to 1.1 mm., and of the females as 1.2. My specimens average in length, males, 1.47 mm., females, 2 mm.

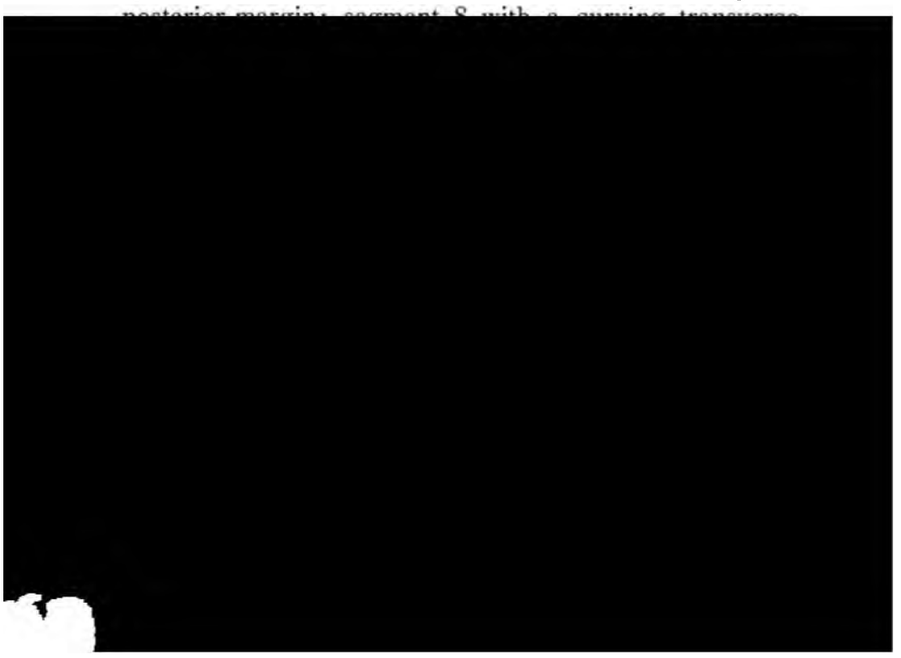
Description of the male. Body, length 1.47 mm., width .59 mm.; thorax and head pale golden brown, with light brown markings; abdomen darker, with large dark brown lateral blotches.

Head, length .5 mm., width .48 mm.; front of clypeus emarginated rather squarely, the bounding mesal angles of the clypeus nearly rectangular; a longish prominent hair rising from the dorsal surface near the margin in each rounded latero-anterior angle of the clypeus, a short marginal hair behind it, another at the suture, two others close together and rising from the dorsal surface near the margin behind the suture, and a single short, marginal hair just in front of the trabeculæ; the trabeculæ large, acutely pointed, reaching middle of segment 2 of antennæ; antennæ, if projected backwards, reach the

posterior margin of the head; eye prominent, with a longish hair; temporal margin with one hair behind, but close to the eye, and two other hairs and two prickles; occipital margin sinuous, bare; signature indistinct, with anterior margin emarginate; no distinct posterior point; occipital bands brown, forking; antennal bands pale smoky brown, interrupted.

Prothorax with rounding sides and angles, rather long, and with a single hair near each end of posterior margin; a broad, even, translucent, lateral band. Metathorax rather long, angulated on abdomen, with a series of pustulated hairs along posterior margin and a broad, lateral, brown band along the antero-lateral sides. Legs robust, pale brown, with dark brown marginal markings and few scattered hairs.

Abdomen broadly elliptical, segments projecting slightly laterally, with one to two or three long hairs in the posterior angles; dorsal surface with numerous weak hairs arranged in transverse lines, a single series on each segment; segments 1–7 with large, dark brown, transverse, lateral blotches, each blotch with an uncolored stigmatal spot, and a few demi-pustulations with hairs along the



Docophorus distinctus n. sp. (Plate lxv, fig. 5.)

Many specimens, males, females, and young, from the American Raven, *Corvus corax sinuatus* (Colorado). This form belongs to the *corvinicolæ* infesting the Corvini and is of the type *atropicti* characterized by the whitish ground color of the body, and sharp black markings. The new species differs from Nitzsch's *atratus* (Giebel, Insecta Epizoa, p. 81, pl. ix, fig. 10) from *Corvus frugilegus* by the long hairs of the clypeus; from Nizsch's *ocellatus* (Giebel, Insecta Epizoa, p. 81, pl. ix, figs. 7 and 8), from *C. cornix* and *C. corone*, by lacking the strongly marked bands on the temples, and by the short signatures; and differs from Piaget's *albidus* (Les Pediculines, p. 48, pl. iii, fig. 6) from *C. scapulatus* by the pustulated hairs of temples and metathorax.

Description of the male. Body, length 2 mm., width 1.06 mm.; ground color whitish with distinct, sharply defined, black markings.

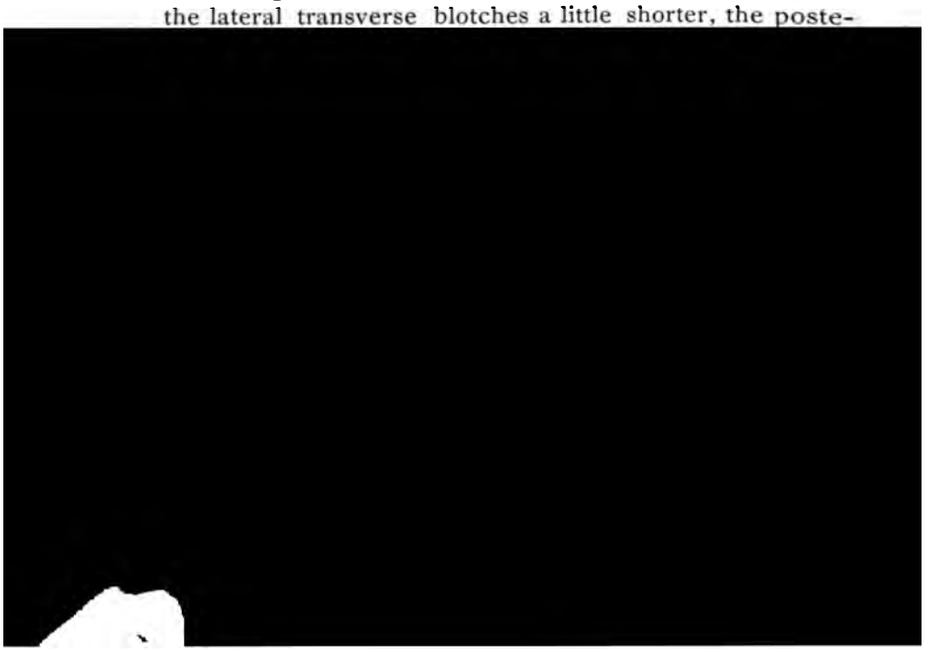
Head, length .63 mm., width .72 mm.; very broad in front and truncate; five long marginal hairs on each side of forehead, one at base of antennæ, one in eye, one just behind the eye, and three on the temporal margins; occipital margin straight, bare; antennæ with segment 1 large and swollen, segment 2 slender and longest, segments 3–5 short, subequal and colored dark brown, segments 1–2 uncolored; signature very short, or at least with only a short, oblong, anterior part colored; antennal bands broad, irregular, interrupted at the suture, and with subparallel inner bands; occipital bands very distinct, diverging and meeting the expanded basal extremities of the antennal bands; ocular bands narrow, distinct, and extending around behind the eye; a shield-shaped occipital signature showing through.

Prothorax narrow, with strong, black, lateral borders,

and a fainter narrow diagonal line running inward and backward from each side; the pericoxal and intercoxal lines of prosternum showing through; one hair in each posterior angle. Metathorax angulated on abdomen, with a series of pustulated hairs along posterior margin; antero-lateral sides with strong black border; postero-lateral sides with paler, brown, linear, tapering blotch. Legs concolorous with body, with black marginal and annular markings.

Abdomen very broadly elliptical, suborbicular; not turbinated; with long weak hairs in posterior angles; last segment flatly rounded behind; the transverse lateral blotches smoky brown, with darker lateral borders, large uncolored stigmatal spots, and about six demi-pulstulations along the posterior margin of each blotch; some of the outermost of these pustulations are complete; many weak hairs on dorsal surface; genitalia showing distinctly in segments 6–9, broad and shortly three-pronged posteriorly; segment 8 with transverse blotch entirely across segment; segment 9 uncolored.

Female. Body, length 2.5 mm., width 1.34 mm.; head, length .72 mm., width .81.; abdomen more elongate, the lateral transverse blotches a little shorter, the poste-



This forcipated clypeus is found also in *D. pertusus* N. (on *Fulica*) of the group *emarginati*.

Description of female. Body, length 2 mm., width .9 mm.; forehead light golden brown, hindhead dark brown, thorax and abdomen strongly blotched with dark brown, abdomen with interrupted narrow, black, lateral bands.

Head, length .56 mm., width .59 mm.; front with a subcircular emargination enclosed in front by mesad-projecting, acute, forceps-like points; no marginal hairs on forehead excepting three or four short ones just in front of trabeculæ; the trabeculæ are rather long, reaching beyond end of segment 1 of antenna; eye with a hair; temporal margins with two longish hairs and a short one between them; occipital margin sinuous, bare; signature broad and very pale, and indistinct anteriorly, with a short, obtuse, posterior point which is darker colored; antennal bands broad, short, paling into general color of forehead; ocular bands fairly distinct, as also the occipital bands; temporal regions dark brown with narrow blackish border outwardly; a narrow black occipital border.

Prothorax with rounding sides and angles, with a single weak hair in each posterior angle; broad, dark brown lateral borders paling outwardly and darkest in posterior angles; two indistinct narrow dark lines running diagonally inward from each lateral border. Metathorax with rounding lateral angles, obtusely angled on abdomen and with a series of pustulated hairs along posterior margin; two linear transversal blackish blotches projecting inward from each side, the anterior blotch much the larger and more distinct. Legs dark brown with blackish marginal markings and semiannulations at extremities of femora.

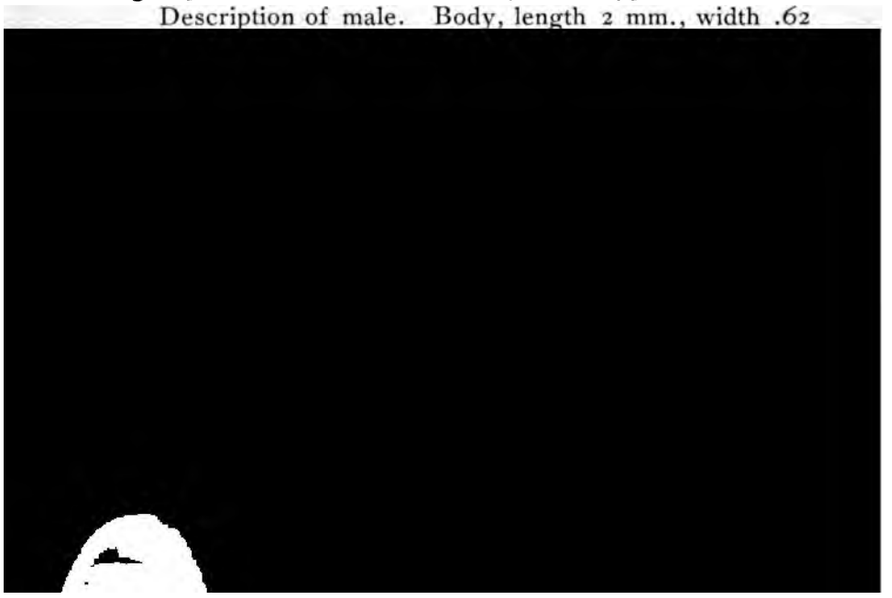
Abdomen obovate, sides somewhat turbinate but with the projecting angles rounded; segments 3–6 with two

or three short hairs in posterior angles, segment 7 with one hair in angle; segment 8 much narrower than segment 7 and somewhat retracted into it; segment 9 hardly visible, being almost wholly concealed within segment 8; segment 1 with complete transverse blotch deeply medianly emarginated on its anterior margin; segments 2–7 with lateral, dark brown, transverse blotches separated by the paler median third of the body surface and blunt within; each blotch with a distinct uncolored stigmatal spot, but without pustulated hairs; blotch of segment 8 extending entirely across segment; four longitudinal rows of weak nonpustulated hairs, two rows in median paler space, and one row in each lateral series of transverse blotches; distinct, black, lateral bands widening posteriorly and segmentally interrupted.

Docophorus evagans n. sp. (Plate lxvi, fig. 2.)

Taken from the Downy Woodpecker, *Dryobates pubescens* (Lawrence, Kansas). This *Docophorus* is a member of Piaget's woodpecker infesting group *angustifrontes*, characterized by the anterior narrowing of the head with small trabeculæ, and the elongate Nirmoid form of the body. It departs from the more typical forms of the group, however, in the relatively wide clypeal front.

Description of male. Body, length 2 mm., width .62



margins with two longish hairs; occipital margin weakly concave, almost straight and bare; narrow antennal bands, and temporal borders shining dark brown.

Prothorax short, with narrow marginal band and no hairs. Metathorax acutely angled on abdomen, the angle produced; beginning in lateral angle five long hairs along each latero-posterior margin, the mesal third of the posterior margin being free from hairs; a narrow, indistinct, lateral border. Legs concolorous with body, with narrow, dark brown, marginal markings. Sternum with narrow distinct intercoxal lines.

Abdomen elongate, subparallel-sided; a single longish hair in posterior angles of segments 3–4, and two hairs in angles of segments 5–8; two hairs also in middle of lateral margin of segment 8; segment 9 uncolored, narrowed and slightly emarginated behind; narrow, translucent, brown lateral bands, and faint indications of median transversal blotches which are probably the light brown transversal blotches of the under side showing through.

Docophorus jungens n. sp. (Plate lxvi, fig. 4.)

Found on two specimens of the Flicker, *Colaptes auratus* (Lawrence, Kansas). The new form belongs to Piaget's group *angustifrontes*, found on the woodpeckers, and presents the characteristic narrow clypeal front, the small trabeculæ, and elongate Nirmoid body. The members of the group undoubtedly stand in the position of gradatory forms between *Docophorus* and *Nirmus*.

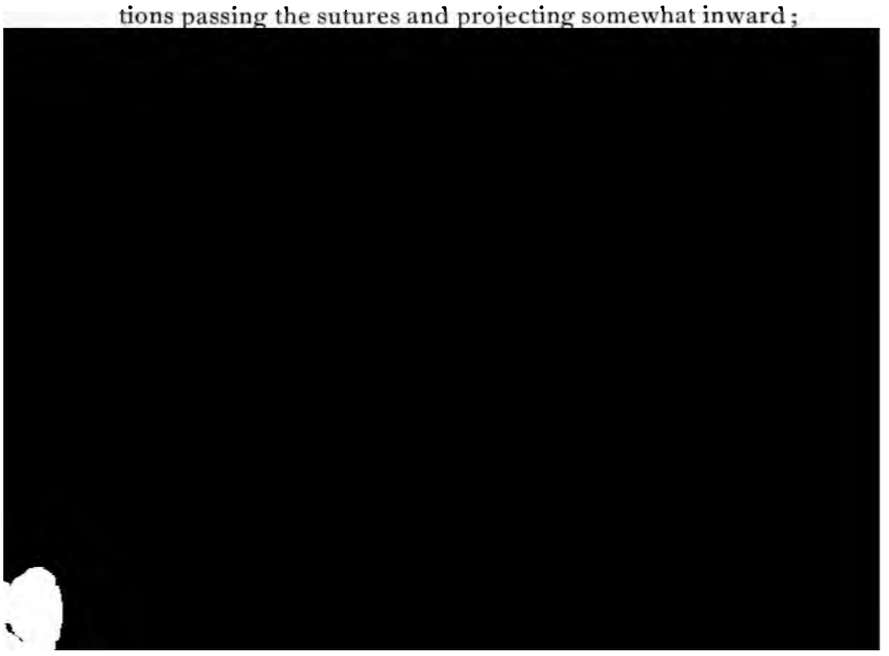
Description of the male. Body, length 1.75 mm., width .65 mm.; very pale brownish, with darker marginal markings.

Head, length .56 mm., width .50 mm.; triangular, with narrow, anteriorly tapering clypeus which is concave in

front; two short hairs just beyond the anterior angles, one short hair at the suture, and two slightly longer ones in front of the rather small trabeculæ; eye distinct, with a long hair; temporal margins flatly convex, with two long hairs; occipital margin weakly concave and sinuous, bare; ground color of head pale yellowish brown with narrow dark brown antennal bands, pale colored signature and narrow brown temporal margins fading out posteriorly; œsophageal sclerite showing through, and occipital bands indicated, especially at their posterior ends.

Prothorax small, with slightly rounded rectangular posterior angles and straight posterior margin, with one hair in posterior angles; pale lateral borders which bend inward at posterior angles. Metathorax short, broad, angulated on abdomen, with indistinct lateral blotch and six hairs along each latero-posterior margin arranged in two groups of three each. Legs concolorous with the pale body, with darker marginal blotches on femora and tibiæ.

Abdomen narrow, with few longish hairs in posterior angles of segments and a transverse series of a few longish hairs across each segment interrupted in the middle; lateral bands translucent pale brown, the segmental portions passing the sutures and projecting somewhat inward;



Docophorus californiensis n. sp. (Plate lxvi, fig. 6.)

Numerous specimens, male, female, and young from several specimens of the California Woodpecker, *Melanerpes formicivorous bairdi* (Palo Alto, California). Another member of the *angustifrontes*, of same size and outline as the last, but with strong and characteristic markings. It is very like *D. superciliosus* N. (Giebel, Insecta Epizoa, p. 94, pl. x, fig. 3), the type of the group taken by Nitzsch, Denny, and Piaget from *Picus major* and *P. viridis*. It appears to differ from *superciliosus* in the possession of hairs in the posterior angles of the prothorax, in the absence of numerous hairs on dorsal surface of abdomen, and in the sharper and more pronounced markings.

Description of the male. Body, length 1.75 mm., width .62 mm.; pale smoky brown, with dark brown to black bands and blotches.

Head, length .53 mm., width .47 mm.; triangular, forehead tapering, and clypeal front narrow and slightly concave, with two hairs in the anterior angles, one shorter one between angle and suture, a longer one just in front of suture, and two rather long ones in front of trabeculæ; eye prominent, with long hair; trabeculæ acute, reaching slightly beyond end of segment 1 of antennæ; temporal margins with two long hairs and a prickle; occipital margin sinuous, bare; clypeus paler than rest of forehead and hind head; signature pale but distinct; suture distinct; antennal bands, ocular blotch, and anterior temporal border blackish brown; temporal regions and rest of head, excepting clypeus and that part of hind head between the occipital bands, dark brown; œsophageal sclerite distinct.

Prothorax short, projecting considerably beneath head; posterior angles rectangular, with one hair; posterior mar-

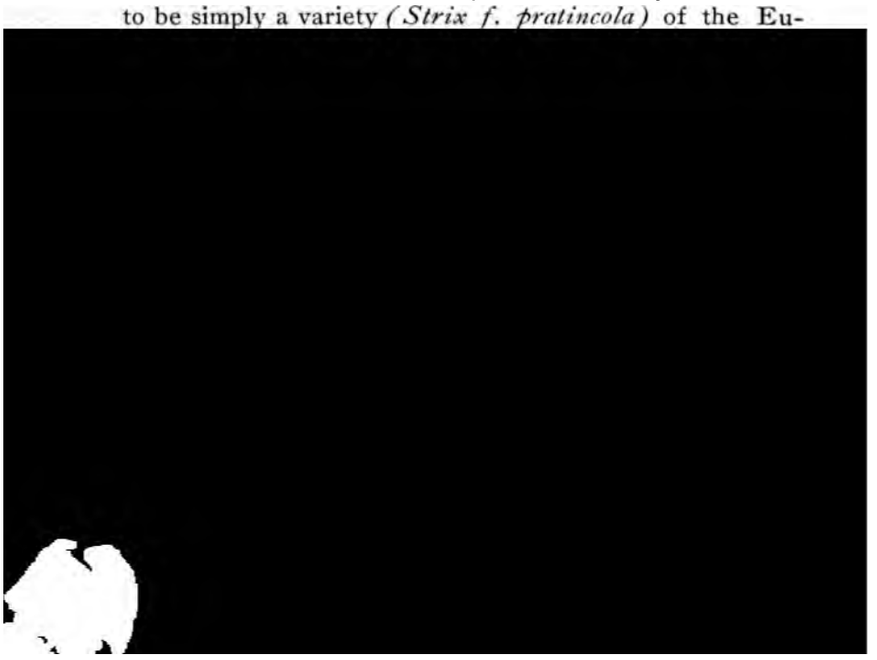
the Snowy Owl. It can be readily recognized by the broad short head, with short broadly truncate forehead, and correspondingly short and broad signature. The genital blotches of the ventral surface of the abdomen of both male and female are also characteristic. There is considerable difference in size of the male and female. The male which I figure measures: Body, length 1.78 mm., width .75 mm.; head, length .53 mm., width .6 mm. Female: Body, length 2.31 mm., width 1.03 mm.; head, length .62 mm., width .75 mm.

Docophorus rostratus Nitzsch. (Plate lxvi, fig. 5).

Zeitschr. f. ges. Naturwiss. (ed. Giebel), 1861, vol. xvii, p. 529.

Docophorus rostratus N., Giebel, Zeitschr. f. ges. Naturwiss, 1861, vol. xviii, p. 296; Burmeister, Handb. d. Ent., 1835, vol. ii, p. 427; Denny, Monograph. Anoplur. Brit., 1842, p. 87, pl. ii, fig. 4; Giebel, Insecta Epizoa, 1874, p. 76, pl. x, fig. 4; Piaget, Les Pediculines, p. 27, pl. i, fig. 7.

Two specimens of this unmistakable *Docophorus*, taken by Nitzsch, Denny and Piaget from *Strix flammea*, the European Barn Owl; taken by me from the American Barn Owl, *Strix pratincola* (Soquel, California). The American Barn Owl has always, until recently, been held to be simply a variety (*Strix f. pratincola*) of the Eu-



Universita di Modena, Atti della Societa dei Naturalisti di Modena, Serie 3, vol. iv, 1895.

"Sinonimia—De-Geer. Mem. Ins. vol. vii, tv. 4, f. 9. 1776 (*Ricinus emberizæ*)—Schrank. Beit. zur Naturg. p. 117, tv. 5, f. 8. 1776 (*Pediculus curvirostræ*)—l. c. p. 117, f. 6 (*P. Pyrrulæ*)—l. c. p. 118, f. 7 (*P. Chloridis*)—l. c. p. 116, f. 9 (*P. citrinellæ*)—l. c. p. 115, f. 10 (*P. Rubeculæ*)—Linneo. Syst. Nat. Ed. xiii, v. ii, p. 2922. 1789 (*P. curvirostræ, Pyrrullæ, Chloridis, Citrinellæ, Rubeculæ*)—Panzer. Fau. Ins. Germ. p. 51, f. 27. 1793 (*P. Curvirostræ*)—Geoffroy. Hist. abr. Ins. v. 11, p. 599. 1800 (*Pediculus Emberizæ*)—Latreille. Hist. Gen. v. viii, p. 111. 1804 (*Ricinus Emberizæ*)—Fabricus. Sys. Ant. p. 349. 1805 (*P. Emberizæ*)—Olfers. De Veg. et. Anim. Corp. Anim. Rep. 1815 (*Nirmus globifer*)—Nitzsch. Germ. Mag. v. iii, p. 290. 1818—Burmeister. Hand. Ent. v. ii, p. 425. 1835—l. c. (*fusicollis*)—Denny. Anop. p. 70, tv. 5, f. 10. 1842—l. c. p. 82, tv. 1, f. 8 (*pallescens*)—l. c. p. 98, tv. 1, f. 8 (*fuscicollis*)—l. c. p. 104, tv. 5, f. 12 (*Passerinus*)—l. c. p. 106, tv. 3, f. 1 (*Merulæ*)—l. c. p. 107, tv. 3, f. 3 (*Modularis*)—l. c. p. 108, tv. 2, f. 2 (*Rubeculæ*)—Walckenær. Hist. Nat. Ins. Apt. v. iii, p. 332. 1844 (*Philopterus*)—l. c. p. 336 (*Philopterus pallescens*)—l. c. (*Philopterus fuscicollis*)—l. c. p. 340 (*Philopterus passerinus, merulæ, modularis, rubeculæ*)—Giebel. Zeits. f. ges. Nat. Bd. xvii, p. 298-303. 1861—l. c. (*fuscicollis*) p. 298—l. c. Bd. xviii, p. 298-303. 1861—l. c. p. 298. 1861 (*fuscicollis*)—Giglioli, Jour. of Micros. N. 10, tv. B, f. 9. 1864 (*Mandarinus*)—Giebel. Zeits. f. ges. Nat. Bd. xxvii, p. 116. 1866 (*ornatus*)—l. c. Bd. xxvii, p. 358. 1866—l. c. p. 359 (*fuscicollis*)—l. c. p. 359 (*ornatus*)—Epiz. p. 85, tv. xi, f. 13. 1884—l. c. p. 86, tv. 11, f. 10, tv. 20, f. 4 (*fuscicollis*)—l. c. p. 89 (*ornatus*)—l. c. p. 120 (*Rubeculæ, Modularis, Merulæ*)—l. c. p. 119 (*turdi*)—l. c. p. 91 (*lineatus*)—Piaget. Ped. p. 54, tv. 4, f. 2, 3, 4, 5, 7 (sp. et var.)."

The specific name *communis* given by Nitzsch to a *Docophorus* species or group of closely allied species found commonly on passerine birds, has been retained by Giebel and Piaget as the best, or, at least, most convenient expression of the condition exhibited by the *Docophori* of the type figured by Nitzsch from specimens from *Fringilla linaria*, and by Piaget from specimens from *Motacilla alba* and others. Specimens of this type are the most commonly met with *Docophorus* on

passerine birds, and have been recorded from many species. Picaglia (l. c., p. 16) lists 43 species of European Passeres from which *communis* has been collected. But the variations exhibited by the specimens from the various bird species are many and sometimes striking. Giebel refers to variations exhibited by specimens from certain birds as being sufficient to warrant the founding of new species, but he merely refers to the general character of the variation shown by specimens from *Turdus pilaris*, *Parus major*, *Fringilla chloris*, and *Motacilla alba*. He lists 29 passerine birds representing 15 genera on which *communis* had been found at time of his writing. Piaget holds to the single species *communis*, referring to the variations apparent in any series of specimens, and describes and gives varietal names to 11 varieties. He selects the form found on *Motacilla alba* as typical of the species (believing it to be the same as found by Nitzsh on *Fringilla linaria*) and lists nearly 20 passerine bird species on which he has found *communis* and its varieties.

I have collected specimens of this *communis* species or group of species from the following American passerine birds: the Horned Lark, *Otocoris alpestris;* Red-winged Blackbird, *Agelaius phœniceus;* Western Meadowlark

wich Sparrow, *Amodramus sandwichensis*, from Palo Alto, California.

Variations among the specimens are apparent, but until I can examine a much larger series no attempt can be made to tabulate these variations. The species may be recognized by comparison with the figure in plate lxvi. This specimen, a female, was taken from a White-rumped Shrike, *Lanius ludovicianus excubitorides* (Lawrence, Kansas), and measures: Body, length 2. mm.; width .87 mm.; head, length 6 mm.; width .6 mm.

Docophorus excisus Nitzsch.

Germar's Mag. f. Ent., 1818, vol. iii, p. 291.

Pediculus hirundinis Linnæus, Fau. Suec., 1746, p. 1963; Schrank, Fauna Boica, 1781; Fabricius, Sp. Ins., 1783, vol. ii, p. 483; Linnæus, Syst. Nat., ed. 13, 1779, vol. i, p. 2921.

Ricinus hirundinis Latreille, Hist. Gen., 1804, vol. viii, p. 111.

Philopterus excisus Nitzsch, Germ. Mag. f. Ent., 1818, vol. iii, p. 291; Burmeister, Handb. d. Ent., 1835, vol. ii, p. 425; Walckenaer, Hist. Nat. Ins. Apt., 1844, vol. iii, p. 333.

Docophorus excisus Nitzsch, Giebel, Zeitschr. f. ges. Naturwiss., 1861, vol. xviii, p. 298, l. c. 1866, vol. xxviii, p. 359; Giebel, Insecta Epizoa, 1874, p. 88, pl. ix, figs. 1, 2, 3; Piaget, Les Pediculines, 1880, p. 64, pl. iv, fig. 6.

Specimens which may be referred to this long known parasite of the swallows taken from the Cliff Swallow, *Petrochelidon lunifrons*, and from the Tree Swallow, *Tachycineta bicolor* (Palo Alto, California, and Lawrence, Kansas). The American specimens are, however, markedly larger than the European ones and should be designated by a varietal name. Piaget's measurements are, for males, length 1 m., for females 1.1 mm.; the males among my specimens are about 1.3 mm. long and the females 1.5 mm. long. The species of this group (with square emargination of clypeal front) which I have described from the Purple Martin (see page 475, plate lxv, fig. 4) shows all of the general habitus of *excisus*, but is

so conspicuously larger and presents such constant minor differences that I have made it the type of a new species. The figure of it, however, will serve very well as a means of recognizing the American variety of *excisus*.

Var. *major* Kellogg. Male. Body, length 1.3 mm., width .56 mm.; head, length .44 mm., width .40 mm. Female. Body, length 1.49 mm., width .62 mm.; head, length .45 mm., width .42 mm.; the pustulations in lateral abdominal blotches more complete and distinct than in the type form of the species. Males, females, and young found on the Cliff Swallow, *Petrochelidon lunifrons*, and on the Tree Swallow, *Tachycineta bicolor* (Palo Alto, California, and Lawrence, Kansas).

NIRMUS.

Nirmus longus n. sp. (Plate lxvii, fig. 1.)

Taken from the Tree Swallow, *Tachycineta bicolor* (Lawrence, Kansas), and from the Cliff Swallow, *Petrochelidon lunifrons* (Palo Alto, California). A member of the group *interruptofasciati* and allied to Nitzsch's *N. gracilis* (Insecta Epizoa, p. 143, pl. vi, figs. 11, 12), which is only half as large and has but four (Giebel) or

Head, length .37 mm., width .28 mm.; elongate-conical, with narrow truncate front; two very small marginal hairs near the front, and one slightly longer a little distance in front of the trabeculæ which are small but distinct; eye flat, with a prickle in its posterior margin; temporal margins flat with a long hair and a prickle; pale golden brown with dark brown narrow antennal bands and temporal borders; oral fossa elongate, expanded behind, nearly uncolored.

Prothorax short, small, oblong, with single short hair in posterior angle, and even lateral borders which bend inward along posterior margin. Metathorax trapezoidal, with lateral margins converging anteriorly; posterior margin straight or weakly convex on abdomen, more curved at each end which projects laterally beyond the abdomen; posterior margin with six longish but weak hairs on each lateral third; indistinct lateral borders with anterior ends more distinct and a diagonal line projecting inward and forward from the posterior angles. No pronounced sternal markings. Legs pale, concolorous with body, with narrow darker marginal markings.

Abdomen very long and apparently slender, although really one-third wider than head; abdominal segments very gradually growing wider until segment 6 is reached, segment 7 slightly narrower, segments 8–9 narrower, abruptly tapering; a single short hair in posterior angles of segments; dorsal surface naked; segments 1–7 with distinct chestnut brown lateral bands; segment 8 of general body color; segment 9 uncolored, emarginated behind, with rounded points.

Male. Two males, which with much hesitancy I assign to this species, taken from a Cliff Swallow, *Petrochelidon lunifrons* (Palo Alto, California), are much smaller than the females. This condition is similar to that pre-

sented by *gracilis*, the males of which are .7 mm. long, while the females are .95 mm. long. The arrangement and number of metathoracic hairs are the same as in the females, and the head characters agree. Measurements of the male: Body, length 1.47 mm., width .43 mm.; head, length .34 mm., width .31 mm.

Nirmus simplex n. sp. (Plate lxvii, fig. 2.)

Found on a Robin, *Merula migratoria* (Lawrence, Kansas). It belongs to Piaget's group *interruptofasciati*, with antennal bands interrupted, with temples tending to become angular, and with the body blotches indistinctly colored.

Description of female. Body, length 1.77 mm., width .62 mm.; very pale yellowish brown, with darker but inconspicuous markings.

Head, length .53 mm., width .50 mm.; bluntly triangular, the rather narrow clypeal front truncate or very weakly concave; a single short hair in anterior angles and two other shorter ones on lateral margins; trabeculæ small, acute; eye flat, with a prickle in posterior edge; temporal margins flatly convex, with a single long hair and two prickles just in front of it; occipital margin straight, bare; signature indistinctly colored, broad, emarginate in front and truncate behind; antennal bands

Metathorax broad, short, obtusely angled on the abdomen, with a series of non-pustulated hairs along posterior margin; a lateral marginal blotch with a part extending inward. Legs concolorous with body, with only faintly indicated marginal markings.

Abdomen bluntly elliptical, one-fifth wider than the head; with one to two or three weak hairs in posterior angles of segments, and a single transverse series of short weak hairs along the posterior margin of each segment; translucent, smoky brown lateral bands, and pale brown, broad, transverse blotches entirely across all segments; distinct uncolored stigmatal spots; segment 9 uncolored, with two small pale brown lateral blotches, slightly emarginated behind, and with a few longish hairs.

Nirmus eustigmus n. sp. (Plate lxvii, fig. 3.)

A single female of this well marked form from an Anna's Hummingbird, *Trochilus anna* (Palo Alto, California). The species belong to Piaget's group *interruptofasciati*. It is a much broader and much more robust form than *N. vulgatus*, the *Nirmus* of this group common among passerine birds, and the lateral bands of the abdomen are broad and pronounced.

Description of the female. Body, length 1.84 mm., width .62 mm.; pale yellowish white, with narrow blackish brown head borders, and broad, blackish lateral abdominal bands; indications of pale brown abdominal blotches.

Head, length .42 mm., width .45 mm.; broadly triangular, narrowly truncate in front; a few short weak hairs along margins of forehead, the longest being a pair considerably in front of the trabeculæ; trabeculæ small and uncolored but distinct; antennæ short, segment 2 most

colored, segment 3 next; eye with a prickle; temporal margins with a single long hair and some fine prickles; occipital margin straight, bare; antennal bands blackish brown, not quite meeting in front, leaving a small uncolored space on frontal margin, and bending angularly in at posterior ends; narrow blackish brown ocular and temporal margins, paling gradually inward from margin of head.

Prothorax short, rectangular, with a single hair in posterior angles; blackish brown lateral borders. Metathorax trapezoidal, posterior margin very flatly convex on abdomen, with an angular indication at middle; six pustulated hairs on each outer third of the posterior margin; broad, ill-defined lateral border, with transversal lateral blotch extending from each side. Legs pale, with blackish brown dorsal marginal markings. Sternum with intercoxal lines but no median blotches.

Abdomen, elliptical; broad for this group of *Nirmi*, with posterior angles of segments, uncolored, blunt, projecting slightly; two or three hairs in posterior angles and a series of four longish hairs on the posterior margin of each of segments 2-7; segment 1 without hairs and segment 8 with more than four hairs; whitish, with dis-

Description of male. Body, length 1.56 mm., width .52 mm.; whitish, with brown median blotches and black marginal bands.

Head, length .37 mm., width 37 mm.; truncate or very slightly convex in front, with two or three very short indistinct marginal hairs; trabeculæ small and weak, reaching half way to segment 1 of antennæ; eye indistinct, with a fine prickle; temporal margins with two prickles and a weak hair; occipital margin straight, bare; antennæ with segment 1 uncolored; other segments dark brown, with wide uncolored sutures; antennal bands narrow, black, angulated almost at right angles and with the black color interrupted just in front of the angulation; bases of antennal bands meeting the inner ends of distinct, narrow, ocular bands whose outer ends meet anterior ends of narrow black temporal borders, with inner margins slightly crenate; short black internal bands parallel with anterior marginal parts of antennal bands; a shield-shaped occipital signature and oblong blotches at its sides showing through from under side.

Prothorax with flatly rounded sides and rounded posterior angles, each angle bearing one small hair; anterior angles containing a large dark brown blotch, and intercoxal lines of sternum showing through as black diagonal lines in posterior angles. Metathorax with rounding margins, rounded on abdomen, with five weak hairs in each lateral fourth of the posterior margin; small black linear blotches in anterior angles, and large irregular black lateral blotches not contiguous to the lateral margins, the sternal markings showing through dark chestnut brown. Sternal markings consisting of intercoxal lines and a median blotch on metasternum. Legs, femora and tibiæ with dorsal marginal black markings and a blackish brown annulation near distal extremity; tarsi paler brown.

Abdomen elongate, subparallel-sided, with posterior angles of segments projecting slightly, pointing backward and each bearing two weak hairs; dorsal surface of segments naked; last segment projecting, parabolic behind, with two pairs of long weak hairs and one pair of shorter ones; lateral bands narrow, distinct, black, interrupted, the anterior end of each segmental portion projecting beyond the suture and slightly inward; large median chestnut brown blotches on segments 1–7, each of these blotches (except that on segment 1) nearly crossed by a transverse linear uncolored space; on segments 6–7 the uncolored space is divided into two portions; in addition there are on segments 3–7 a pair of transversal dark brown lines, one on each side of the median line and lying superposed on median blotch, but extending a little farther laterally than the lateral margin of the blotch; some of these markings are on the ventral surface, but show through distinctly; segment 8 has a median blotch and two lateral markings composed of a brown line defining an elongate curving triangle, uncolored within; segment 9 has a median blotch and from its posterior margin two anteriorly projecting lines; distinct, slender, curving side pieces of genitalia limited to segment 8.

hyemalis, and the Robin, *Merula migratoria*, from Lawrence, Kansas.

It is allied to Nitzsch's *densilimbus (Fringilla carduelis)* (Giebel, Insecta Epizoa, p. 138), Piaget's *deficiens* (Les Pediculines, Supplement, p. 23, pl. iii, fig. 3) from *Cyanapolius cooki*, and other similar forms.

Description of female. Body, length 1.62 mm., width .41 mm.; pale, with distinct narrow blackish brown lateral bands and marginal head markings, and pale chestnut median abdominal blotches.

Head, length .37 mm., width .29 mm.; conical, with narrow parabolic front, without hairs; trabeculæ very small and uncolored but distinct; eye flat, with a fine prickle, and another just at its posterior margin; temporal margins with one longish hair and two prickles; occipital margin straight, bare; no signature; a longitudinal oral fossa expanded laterally behind; whole head narrowly bordered along lateral margins with blackish brown, the border turning angularly inward at antennal fossæ; a pale shield-shaped occipital signature showing through from below.

Prothorax narrow, quadrangular, with a single hair in posterior angles; narrow lateral blackish brown border, most strongly colored in anterior and posterior angles. Metathorax almost as wide as head, with flatly rounding posterior margin, with six hairs along each lateral third of this margin, a small transversal linear blackish blotch in anterior angle, and a larger lateral irregular curving blackish blotch in middle of lateral regions of segment. Legs with pale brown ground color, mostly tinged with translucent smoky brown and with darker marginal and annular markings.

Abdomen elongate, slender, subparallel-sided, not tapering posteriorly until segment 8 is reached; with short

weak single hairs in posterior angles of segments and naked dorsal surface; pale ground color, with narrow, distinct, dark brown lateral bands and paler broad, rectangular transverse blotches, darker on posterior segments; a rather broad uncolored median longitudinal line; segment 1 with transverse blotch entirely across segment; segment 9 uncolored, narrowly notched, and with few long but weak hairs.

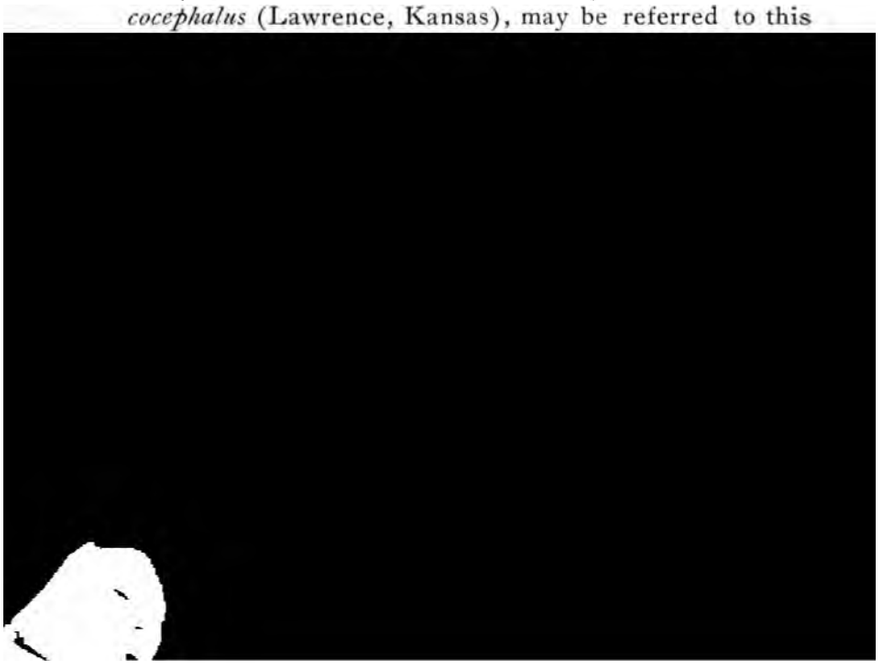
Male. Body, length 1.47 mm., width .4 mm.; head, length .33 mm., width .28 mm.; last abdominal segment protruding, narrowly rounded, with a pair of hairs (one longish, one short) on each side of the middle of the posterior margin; genitalia composed of narrow bars, and showing through in segments 8 and 9.

Nirmus discocephalus Nitzsch. (Plate lxvii, fig. 6.)

Germar's Mag. Entomol., 1818, vol. iii, p. 291.

Nirmus discocephalus Nitzsch, Burmeister, Handbuch d. Ent., 1835, vol. ii, p. 430; Denny, Monograph. Anoplur. Brit., 1842, p. 113, pl. ix, fig. 10; Giebel, Insecta Epizoa, 1874, p. 127, pl. vii, fig. 10; Piaget, Les Pediculines, 1880, p. 129, Supplement, 1885, p. 18, pl. ii, fig. 7.

My specimens, taken from a Bald Eagle, *Haliæetus leucocephalus* (Lawrence, Kansas), may be referred to this



Var. *amblys* Kellogg. Males, females, and young from the Bald Eagle, *Haliæetus leucocephalus* (Lawrence, Kansas). Male, body, length 1.56 mm., width .60 mm.; head, length .47 mm., width .46 mm. Female, body, length 2 mm., width .75 mm.; head, length .52 mm., width .53 mm. Characters of the species as described by Piaget (Supplement, 1885, p. 18, pl. ii, fig. 7), but with head not longer than wide, eyes with a hair, prothorax with a long hair in each posterior angle, metathorax with a spine in each lateral angle and six long hairs on each lateral fourth of the posterior margin.

Nirmus fuscus Nitzsch. (Plate lxvii, fig. 7.)

Zeitschr. f. ges. Naturwiss. (ed. Giebel) 1861, vol. xvii, pp. 523–525.

Nirmus fuscus N., Denny, Monograph. Anoplur. Brit., 1842, p. 118, pl. ix, fig. 8; Giebel, Insecta Epizoa, 1874, p. 123, pl. viii, fig. 2; Piaget, Les Pediculines, 1880, p. 130, pl. x, fig. 9.

Specimens of a large variety of this *Nirmus* of the Eagles and Hawks from Swainson's Hawk, *Buteo swainsoni;* from the Marsh Hawk, *Circus hudsonius;* and from the American Roughlegged Hawk, *Archibuteo lagopus sancti-johannis*—all from Lawrence, Kansas. The American form of *fuscus* (if it be not a new species, indeed) differs markedly from the European type or any of its rather many varieties by being much larger, my specimens being fully one-third larger than the *fuscus* specimens taken from *Buteo vulgaris* by Nitzsch and Piaget. If the various species of Giebel, *fuscus, stenorhynchus* and *leucopleurus* (Insecta Epizoa, pp. 124, 129), be only varieties of *fuscus* as Piaget believes (Les Pediculines, p. 131), then *fuscus* has been taken from *Buteo vulgaris, Milvus ætolius, Falco brachydactylus, Parus cærulens!, Aquila nævia, Circus rufus, Milvus ictinus, Ardea gularis!* (Piaget), *Archibuteo lagopus, Circus cyaneus, Circus æruginosus* and *Milvus regalis.* If in addition

rufus N. with its numerous varieties belongs to the same species, nine or ten more hawk hosts should be enumerated. Without doubt this *Nirmus* type (elongate, with circumfasciate head, broad transverse median abdominal blotches, and distinct lateral bands with the segmental parts passing the sutures) is not yet at all understood. My specimens show the sharp, narrow emargination of the anterior margins of the first and second median abdominal blotches, which has been given as characteristic of *rufus* N. In size, however, the American specimens are distinct from any of the Old World members of the *fuscous* group. The female specimen I figure is from a Marsh Hawk, *Circus hudsonius*, and measures: Body, length 2.4 mm., width .62 mm.; head, length .6 mm., width .5 mm.

Lipeurus.

Lipeurus introductus n. sp. (Plate lxviii, figs. 1 and 5.)

Six females, two males, and an immature specimen from a Silver Pheasant, *Phasianus nycthemerus*, received by the Department of Zoology of this University from Mr. A. C. Robison of San Francisco. This Old World

and because of numerous minor differences, such as the definite and characteristic number and arrangement of the long hairs of the metathorax, the presence of a hair on the temporal margins of the head, and the character of the genital blotch of the female.

Description of the female. Body, length 2.8 mm., width .66 mm.; colored and marked like *variabilis;* whitish, with distinct black lateral borders and chestnut median abdominal blotches concave on the sides.

Head, length .66 mm., width .5 mm.; in general like *variabilis*, but without ocular bands, or rather with large, subcircular ocular blotches in place of ocular bands (Giebel found merely "ein schwarzer Punkt" in *variabilis);* temporal margins not bare as in *variabilis*, but with a prickle behind the prominent eye, and a distinct hair and a prickle at the posterior angle.

Metathorax with a single long hair in the apex of the posterior angle, and just inside of this a white space with four long hairs (two in *variabilis).*

Abdomen not wholly bare except in angles, as Piaget's description of *variabilis* says, but with two longitudinal submedian rows of weak hairs, each in a small but distinct clear spot; the characteristic small triangular genital blotch of the female of *variabilis* is wanting, being replaced by a short, broad, oblong blotch which is united to the ventral segmental blotch preceding it, this segmental blotch being united also with the one preceding it.

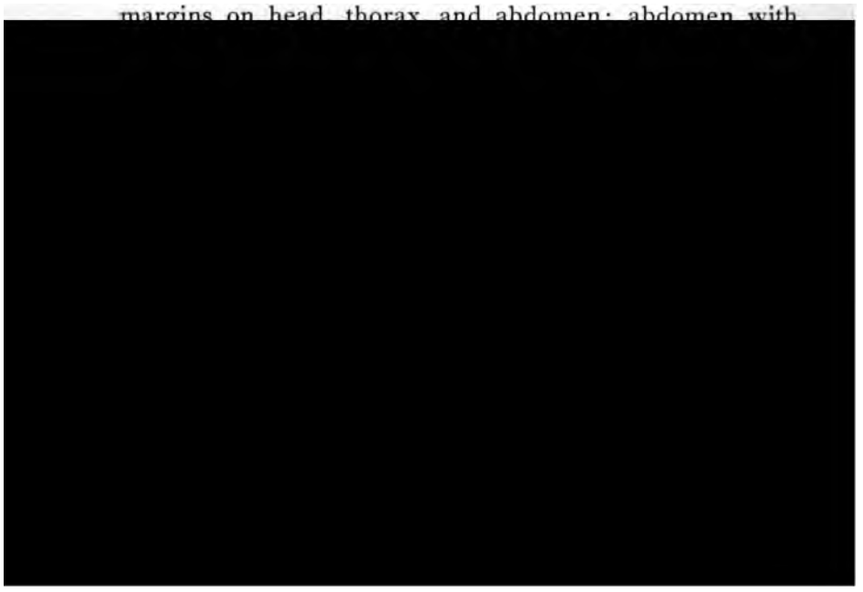
Male. Body, length 2.5 mm., width .5 mm.; head, length .56 mm., width .4 mm.; with the strangely shaped head of *variabilis*, wider in front of the antennæ than across the temples; distinct black antennal bands, ocular blotches, and borders of posterior angles of temples running along posterior margin and terminating in a subcircular head; trabeculæ (wanting in female) peculiarly

slender, finger-like; the great antennæ with large first segment with slender blunt horn-like appendage nearer the base than tip; third segment also appendaged. Metathorax with an additional long pustulated hair on posterior margin on each side, just inside of white space bearing four long hairs. Brown median abdominal blotches broader than in female, separated from the black lateral bands by a narrow whitish space; the strongly chitinized genitalia extending through segments 5–8; broadest in segment 5, tapering in segments 6–7, and uniform, narrow, two-pointed in segment 8.

Lipeurus snodgrassi n. sp. (Plate lxviii, fig. 2.)

A single female specimen of this strongly characterized *Lipeurus* from the Red-backed Rufous Hummingbird, *Trochilus rufous* (Palo Alto, California). This species resembles no other *Lipeurus* at all closely, though in the shape of the head and its peculiar length of forehead, in the short metathorax and heavy abdomen, there is suggested an affinity with *Lipeurus macrocephalus* Kellogg, taken from the Western Nighthawk, *Chordeiles virginianus henryi* (Palo Alto, California). See plate lxviii, fig. 3.

Description of female. Body, length 2.2 mm., width .56 mm.; whitish with sharp, black, rather broad lateral margins on head, thorax and abdomen; abdomen with



uncolored trabeculæ; antennæ rather long, slender; segment 2 longest and very slender, especially at base, segment 3 slightly longer than segment 4, and segment 5 slightly longer than segment 3, segments 3–5 colored, with uncolored distal extremities; eyes small, but slightly produced, and with a hair; temporal margins very slightly convex, with two long hairs; occipital margin straight, bare; lateral margins of forehead and hind head bordered with black, widest on temples, and with uneven inner margin on forehead; the lateral borders of forehead pass the anterior lateral angles but do not run clear across the front, although a clear, slightly colored, even chitin band borders the entire clypeal front; mandibles and œsophageal sclerite distinct, dark brown, and an occipital signature acutely pointed anteriorly showing through from under side.

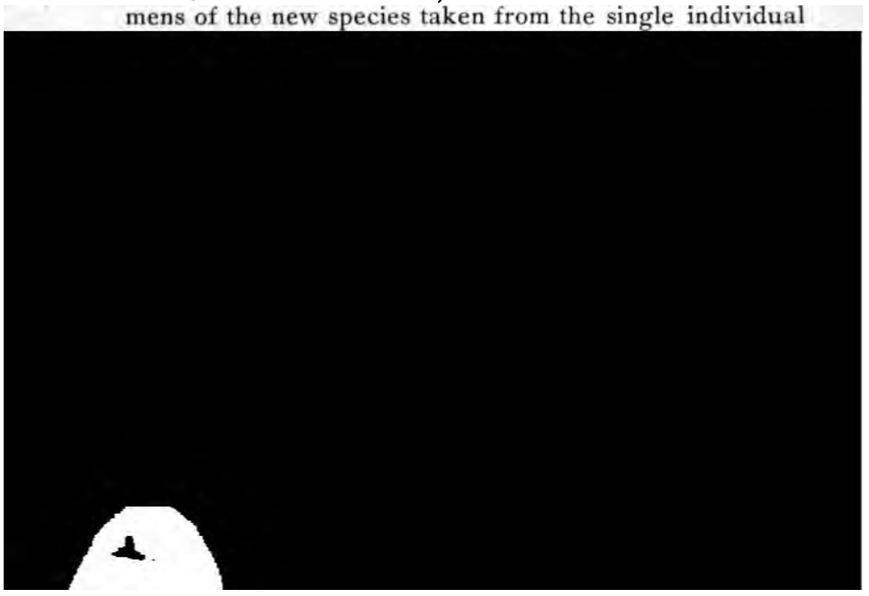
Prothorox short, quadrangular (that part not covered by the head), with rounding posterior angles and straight posterior margin; without hairs; whitish, with broad black lateral borders. Metathorax short, but little longer than prothorax, broader than long, with diverging sides which are slightly concave anteriorly, and straight, bare, posterior margin; the posterior angles with five long hairs in two groups of two and three, rising from white spaces, the group of two hairs really situated on the outer part of posterior margin; segment white, with broad lateral borders which are widest in posterior angles and extend inward, tapering along the posterior margin, not reaching the middle of the segment; metasternum with a brown median blotch; legs whitish, with distinct blackish border on femora and tibiæ, and annulations on femora; coxæ almost wholly colored, and tarsi brown.

Abdomen elongate, subparallel-sided, with a few longish hairs on dorsal surface; whitish, with sharply marked

lateral bands with short sharp irregular inward projecting processes; segment 3–6 with oblong, median, brown blotches, darker on segments 5–6 and not reaching the lateral bands; segment 8 with a narrow angulated or curving transversal black line connecting the lateral bands; segment 9 uncolored or whitish, angularly but not deeply emarginated.

Lipeurus macrocephalus n. sp. (Plate lxviii, fig. 3).

Many specimens taken from a Western Night Hawk, *Chordeiles virginianus henryi* (Palo Alto, Calif.). This species shows an affinity with *Lipeurus hypoleucus* N. (taken by Nitzsch in 1814 from *Caprimulgus europœus*, and first called by him *Nirmus concolor*, and then *N. hypoleucus*, under which name Giebel, Insecta Epizoa, p. 146, pl. viii, fig. 5, and Denny, Monograph. Anoplur, Brit., p. 141, pl. vi, fig. 8, refer to it; and finally correctly removed by Piaget, Supplement, p. 66, pl. vii, fig. 3, to *Lipeurus*) by the general outline, the hairs of the head, and the character of the thoracic segments. The new species differ from *hypoleucus* distinctly, especially in the shape of the head and the character of the signature. Oddly enough Piaget was unable to find a male among his specimens, and among the twenty-seven specimens of the new species taken from the single individual



one next to the most anterior being the longest; behind the suture two longer hairs; and rising from the base of the trabeculæ a long hair from the prominent eye, and two very long hairs and two prickles on the temporal margin; occipital margin flatly concave, nearly straight, bare; antennæ slender, all segments weakly colored, with uncolored tips; trabeculæ small but distinct, uncolored; brownish white, with signature and temples brown, and distinct occipital and interrupted antennal bands blackish brown; the signature is broad and short, obtusely angled behind, and shows a number of small whitish subcircular spots; internal bands (*i. e.* margins of the ventral furrow running anteriorly from the mouth) showing through faintly.

Prothorax quadrangular, a little broader than long, with slightly diverging sides, and straight, bare, posterior margin; no hair in posterior angles; ground color that of the head, with narrow uncolored median longitudinal line forking at anterior end; broad dark rusty brown lateral borders. Metathorax but little longer than prothorax, with diverging sides; lateral margins with a slight but distinct rounding concavity near anterior end; posterior margin straight; posterior angles with three longish hairs, and a group of two on posterior margin near the angle; these two and two of the three in angle pustulated; ground color of segment same as or slightly darker than prothorax, with uncolored median longitudinal line, and lateral irregular dark brown lateral borders, narrower than those of prothorax. Legs long, coxæ elongate, brown, with whitish distal ends; femora and tibiæ concolorous with pale ground color of thorax, with rusty brown marginal markings. Sternal markings composed of rather short, broad intercoxal lines between pro- and meso-legs, connecting with a short, narrow

transverse median blotch; on metasternum oblong intercoxal blotches, and a large median blotch longer than wide and pointed posteriorly.

Abdomen elongate, subparallel-sided; segments 1, 7 and 8 short; segment 9 very short; posterior angles of segments with a series of five longish fine hairs arising from very small but distinct pustulations near the posterior margin of each segment; beyond this series at each end and near the posterior margin a longer, stronger hair on larger pustulation; all segments except segment 9 with a broad chestnut brown transverse blotch covering all of the segment; stigmatal spots clear; narrow dark rusty brown lateral bands; sutures uncolored; segment 9 uncolored, with two faint brownish lateral blotches, weakly angularly concave behind, without hairs, except two very short prickles, one on each half of posterior margin,

Lipeurus baculus Nitzsch. (Plate lxviii, figs. 4 and 6.)

Germar's Mag. Entomol., 1818, vol. iii, p. 293.

Pulex columbæ majoris Redi, Opusculorum pars I, sive experimenta circa generationem Insectorum, 1686, pl. ii; Albin, Nat. Hist. Spiders and Other Curious Insects, 1736, pl. xliii.; Schrank, Enumeratio Insectorum Austriæ, 1781; Geoffrey, Hist. abrégée des Insectes, 1762, vol. ii, p. 599.

Pediculus columbæ Linne, Systema Naturæ, 1767; Fabricius, Systema

Lipeurus bacillus Nitzsch (ed. Giebel) Zeit. f. ges. Naturwiss., 1861, vol. xviii, p. 305; Giebel, Insecta Epizoa, 1874, p. 215, pl. xvi, figs. 8, 9; pl. xx, fig. 3.

Lipeurus antennatus Giebel, Insecta Epizoa, 1874, p. 213.

Lipeurus angustus Rudow, Zeitschr. f. ges. Naturwiss., 1870, vol. xxxvi, p. 137.

Specimens of this long known parasite of doves and pigeons taken from a domestic pigeon, *Columba livia*. I follow Piaget and Taschenberg in their refusal to recognize as species the numerous variants observed. The definition of this species presents a case similar to that presented by *Lipeurus squalidus* (see discussion of *squalidus*).

I figure the female and head of male, not alone for the convenience of American students, but because the previously published figures of this species are faulty. Piaget figures the male. Osborn's figure, undoubtedly well drawn, is spoiled in the printing. Piaget is in error in attempting to correct Giebel's statement that there are four small clavate appendages on the frontal part of the clypeus. Piaget declares there are but two such appendages; in my specimens there are distinctly four. The female specimen figured by me measures: body, length 2.5 mm., width .37 mm.; head, length .42 mm., width .28 mm.

Lipeurus dissimilis Piaget. (Plate lxviii, fig. 7.)

Les Pediculines, 1880, p. 359, pl. xxix, fig. 1.

Two specimens, one immature, from a Bob-white *Colinus virginianus* (Lawrence, Kansas). Piaget described the species from specimens taken from the same bird species in the Zoological Garden of Rotterdam. My specimens differ from Piaget's description in some particulars. Piaget says, "l'œil nu;" my specimens have a distinct longish hair in the eye; the lateral bands

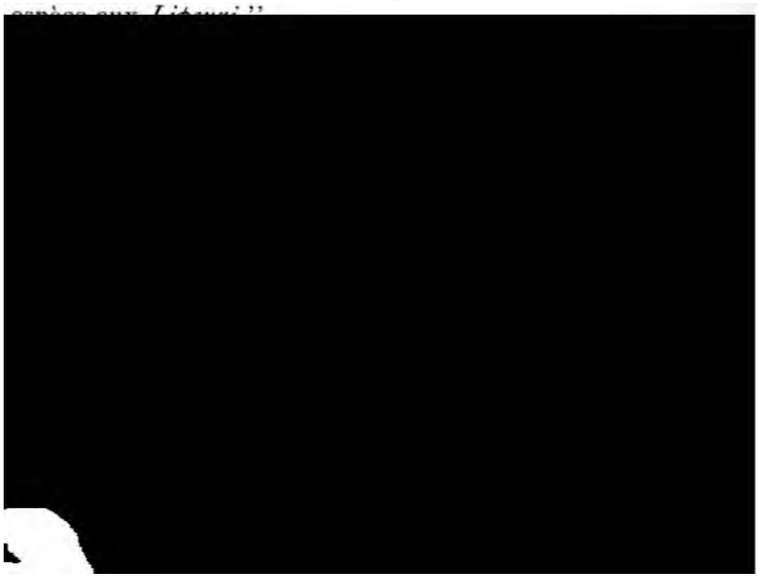
of the abdomen distinctly pass the suture in my mature specimen; Piaget says that the bands do not pass the sutures.

The species may be recognized by its general similarity in form and appearance to *Lipeurus docophoroides* Piaget, of the California Quail (see pl. lxviii, fig. 8). *Dissimilis* differs from *docophoroides* in having the head more rounded in front, the abdomen longer and broader, and in the absence of pustulations at the bases of the hairs. My specimen (mature) measures: Body, length 2.4 mm., width 1.03 mm.; head, length .6 mm., width .53 mm.

Lipeurus docophoroides Piaget. (Plate lxviii, fig. 8.)

Les Pediculines, 1880, p. 357, pl. xxviii, fig. 9.

Two female specimens of this striking *Lipeurus*, taken from a California Partridge, *Callipepla californica* (Mountain View, California). Piaget found his specimens on individuals of the same bird species in the Zoological Garden of Rotterdam. The species is a transition form between *Docophorus* and *Lipeurus*. Piaget says of it: "La forme du thorax, des pattes en général et de l'abdomen, la présence des trabécules indiquent une transition au genre *Docophorus;* l'antenne, la fossette, l'implantation du coxis au bord du thorax, l'étranglement du métathorax, la forme du dernier segment ♂ attachent cette espèce aux *Lipeuri*."



GONIODES.

Goniodes cervinicornis Giebel. (Plate lxix, fig. 1.)

Insecta Epizoa, 1874, p. 199.

Goniodes cervinicornis G., Piaget, Les Pediculines, 1880, p. 272, pl. xxii, fig. 6.

Numerous specimens from a Silver Pheasant, *Phasianus nycthemerus*, sent to the Department of Zoology of this University by Mr. A. C. Robison of San Francisco, Calif. This large and striking *Goniodes* of the pheasants (Giebel's specimens were found by Kollar on *Phasianus nycthemerus*, and Piaget has found it abundantly on *Tragopan satyrus*) is characterized by the peculiar bipartite appendage on the first segment of the antenna of the male. It may be readily recognized by comparison with the figure of the female which I give. My specimens measure; Male: Body, length 3.34 mm., width 2 mm.; head, length .9 mm., width 1.32 mm. Female: Body, length 3.75 mm., width 2. mm.; head, length 1.03 mm., width 1.34 mm. These measurements are markedly greater than those given by Piaget; his male specimens averaging 2.75 mm. long, and the females 3.1 mm. long.

Goniodes mammillatus Rudow. (Plate lxix, fig. 2.)

Zeitsch. f. d. ges. Naturwiss., 1870, vol. xxxv, p. 483.

Goniodes mammillatus Rudow, Taschenberg, Die Mallophagen, 1882, p. 25, pl. i, figs. 1, 1a, 1b.

Two females from a California Partridge, *Callipepla californica* (Mountain View, California). This striking species was first described by Rudow from a specimen taken from *Pelecanus ruficollis!* (a dried skin in some museum). Taschenberg, who collected a number of specimens from *Callipepla californica* (skins?), says: "Wenn die Art wirklick wie Rudow angiebt, auf *Pelecanus ruficollis* angetroffen ist, so ist es in Folge zufälliger

Uebertragung geschehen." The species may be recognized by the broad abdomen and the striking angulated lateral bands of the abdomen, each segmental portion projecting diagonally forward and inward and ending in an indistinctly limited paling brown blotch. Taschenberg says that the head of the male is a little longer than broad, with deep emarginations at the bases of the antennæ, and with strongly angulated temporal margins between which the head is a little narrower than it is just in front of the antennæ. The female figured by me measures as follows: Body, length 2.25 mm., width 1.16 mm.; head, length .62 mm., width .72 mm.

GONIOCOTES.

Goniocotes creber n. sp. (Plate lxix, fig. 3.)

An extraordinary number of specimens on a Silver Pheasant, *Phasianus nycthemerus*, presented to the Department of Zoology of this University, by Mr. A. C. Robison of San Francisco. In addition to the great number of individuals of this *Goniocotes* on the bird, there were present in more than ordinary numbers the giant *Goniodes cervinicornis*, *Lipeurus introductus* n. sp. and *Menopon magnaschum* n. sp. The short feathers

Head, length .44 mm., width .6 mm.; front broad, convex, with ten short prickles; antennæ in a shallow emargination with second segment longest and the fifth longer than third or fourth, which are about equal; eye prominent, with a prickle; the slightly protruding, rounded temporal margins with a prickle and two strong hairs; posterior margin concave in middle, with obtuse angles at each end of the concavity; head brownish, with darker narrow marginal frontal bands ending posteriorly on each side in an expanded darker spot inside of antennal emargination; mandibles and œsophageal sclerite dark brown; an irregular brown ocular blotch and a sinuous dark brown occipital border along the concave curve of the occipital margin.

Prothorax very narrow, short, trapezodial, with lateral margins converging anteriorly, and posterior margins flatly convex; the latero-posterior angles are slightly produced and acute, and each bears a strong hair; indistinct brownish lateral borders. Metathorax with blunt lateral angles, each with two strong hairs; posterior margin obtusely angled on abdomen, and bare except for two hairs near the lateral angles. Legs concolorous with body, with dorsal marginal markings and some scattered spines.

Abdomen broadly elliptical; posterior angles of segments projecting and bearing, except on segment 1, one to three rather short, strong, finely pointed hairs; segment 1 longest at sides but short in middle because of the backward projecting angulated thorax; middle region of abdomen pale to uncolored, faint lateral transverse blotches and conspicuous lateral bands, which on all segments except segment 1 are curved so as to enclose a small uncolored space; the curved band projects inward and forward, passing the suture; the last segment

flatly rounded behind, with a slight angular emargination, the margin bordered by a narrow uncolored space.

Male. Body, length 1.15 mm.; width .7 mm.; head, length .34 mm., width .47 mm.; abdomen as wide as long, suborbicular; median uncolored region of abdomen relatively larger than in female; lateral transverse blotches no more distinct than in female, but lateral bands more strongly chitinized; posterior margin of abdomen broad, straight, with projecting rounded ninth segment in the middle; posterior border of ninth segment colored, the margin with a few short strong hairs; genitalia extending far forward.

Goniocotes compar Nitzsch. (Plate lxix, fig. 4.)

Germar's Mag. Entomol., 1818, vol. iii, p. 294.

Pediculus bidentatus (?) Scopoli, Ent. Carn., 1763, p. 385.

Philopterus compar Nitzsch, Walckenær, Hist. Nat. Ins. Apt., 1844, vol. iii, p. 358.

Goniocotes compar Nitzsch, Burmeister, Handbuch d. Ent., 1835, p. 431; Gurlt, Mag. f. d. ges. Thier., 1842, vol. viii, p. 117, pl. iv, fig. 2; Denny, Monograph. Anoplur. Brit., 1842, p. 151, pl. xiii, fig. 2; Giebel, Zeitsch. f. ges. Nat., 1861, vol. xviii, p. 305; l. c., 1866, vol. xxviii, p. 389; Giebel, Insecta Epizoa, 1874, p. 183, pl. xii, fig. 8; Piaget, Les Pediculines, 1880, p. 284, pl. xix, fig. 10; Taschenberg, Die Mallophagen, 1882, p. 69; Osborn, The Pediculi and Mallophaga Affecting Man and the Lower Animals, 1891

hairs. The posterior margin of the metathorax is angulated and the angle projects so far backward that it nearly cuts the first abdominal segment in two. Professor Osborn's figure is faulty in representing the metathorax with straight posterior margin. The male figured by me measures: Body, length 1.06 mm., width .48 mm.; head, length .34 mm., width .37 mm.

PHYSOSTOMUM.

Physostomum microcephalum n. sp. (Plate lxx, fig. 1.)

A single female from the House Finch, *Carpodacus mexicanus frontalis* (Palo Alto, California). Not common on its host, as I have a record of twelve other individuals of *Carpodacus* from which Mallophaga were taken, but on none of them was this *Physostomum* again found. The new species approaches the general type of *P. agonum* N. (Giebel, Insecta Epizoa, p. 255), from *Sylvia rubecula* and *S. suecia* more nearly than it approaches any other of the Old World species.

Description of female. Body, length 3.6 mm., width 1.25 mm.; head small; abdomen large and exceptionally broad; head markings pale, ill-defined; distinct brown lateral bands; paler colored large median transverse abdominal blotches.

Head, length .66 mm., width .72 mm., thus being wider then long, which is exceptional in *Physostomum*, and being especially small in proportion to the size of the whole body; front flatly rounded, and sides of forehead weakly concave; prickles on front, one hair on margin at extremity of transverse clypeal suture, and a few very short hairs and two longer ones along margin before the eye; eye distinct, with a black fleck; palpi passing the margins of head; the blunt lateral flaps slightly passing the margin; temples not produced very far backward, with a little

narrowed tip at the apex of the posterior angle; temporal margins with three longish hairs and a few short ones; markings weakly colored, a pale chestnut brown.

Prothorax, with distinct lateral angles, in apex of which a spine and a long hair; another long hair near rounded posterior angle, and two spines on margin in front of lateral angle; segment whitish, with faint brownish tinges on lateral borders and elsewhere. Metathorax with weak concavity on lateral margins in front of the middle; two hairs in the posterior angles, and some scattered short spines on margin and dorsal surface of anterior half (mesothorax) of segment; color of prothorax, with brown lateral borders narrowing anteriorly. Legs concolorous with thorax, with narrow darker marginal color.

Abdomen large, expanding in the middle half, and broad and bluntly rounded behind; not very long single hairs in the posterior angles, and on the dorsal surface just inside of the colored lateral bands a double longitudinal row of weak hairs; whitish, with distinct brown lateral bands and large oblong median abdominal blotches, darkest on segments 5 and 6.

Physostomum sucinaceum n. sp. (Plate lxx, fig. 2.)

clypeus clear, almost uncolored; head markings dark brown, but not very sharp; eye with black fleck.

Prothorax with almost no lateral angles, the angles being very obtuse and flattened; two spines and a long hair in the angles and another long hair near the posterior angle; posterior margin of segment concave; a brownish submarginal lateral border. Metathorax with a few small spines along lateral margins, and a longish hair near posterior angles. Legs whitish, paler than body color.

Abdomen with sides only flatly convex, subparallel; single hairs on posterior angles of segments and a longitudinal row of small hairs, one on each segment, on each side inside of the lateral band; lateral bands pale amber brown, not much darker than ground color of body; faint median transverse blotches, apparently nearly square.

Physostomum angulatum n. sp. (Plate lxx, fig. 5.)

Two females taken from a Kingbird, *Tyrannus tyrannus* (Lawrence, Kansas), and one female from a Fox Sparrow, *Passerella iliaca* (Lawrence, Kansas).

Description of female. Body, length 5. mm., width 1.3 mm.; pale golden, with narrow dark brown lateral bands on abdomen and thorax, and few dark brown head markings; the largest *Physostomum* yet found.

Head, length 1 mm., width .94 mm.; front flatly convex, without marginal hairs, sides with two short hairs on dorsal surface near and projecting over the margin even with base of antennæ, and at same place two similar submarginal ventral hairs, and two shorter hairs on margin in the very slight ocular emargination; occipital angles acute and much produced posteriorly (extending nearly to middle of prothorax), bearing three long hairs; occipital margin is thus very concave and is without hairs; palpi projecting beyond margin by half of last segment;

labral lobes inconspicuous, not projecting beyond margin of head; a distinct, curved, dark brown blotch bounding inner margin of antennal fossa; in front of it two paler blotches, the anterior being the larger, and a narrow dark brown occipital border; the rest of head concolorous with the body or paler.

Prothorax hexagonal, the angles rounded, the lateral angles with a longish weak hair and a spine; a distinct, brown, submarginal border laterally, which turns inward at its anterior end and is looped. Metathorax longer than prothorax, with gently sinuous sides, without distinct marginal hairs (a short projecting hair or spine near the posterior angle is not strictly marginal); posterior margin straight; anterior angles with irregular brown blotch, a linear, diagonal blotch on each side near middle, and submarginal lateral bands continuous with those of the abdomen. Legs long, slender, concolorous with the body.

Abdomen elongate-elliptical, truncate anteriorly, with sharply marked dark brown to black submarginal lateral bands composed of segmental parts separated by diagonal sutures and slightly laterally displaced; posterior angles of segments with one or two weak hairs; vulva convex.

Head, length .68 mm., width .7 mm.; front narrow, flatly convex, without hairs; sides with a distinct rounding emargination even with the mouth parts; ocular emargination filled by the conspicuous eye; occipital angles not so acute as in *angulatum*, but projecting backwards nearly to lateral angles of prothorax, and with three longish hairs. Markings similar in position to those of *angulatum* but more pronounced; antennal fossa entirely rimmed and connected with occipital border by a short occipital band; in front of the antennal fossa three blotches (instead of two as in *angulatum*), the most anterior being a short band projecting inward from the lateral margin.

Prothorax with the constriction in front of lateral angles especially marked and the angles with one or two spines but no hair; general color of the segment golden brown, with black submarginal lateral bands. Metathorax with a rounded swelling on anterior third of sides, without marginal hairs and with markings resembling those of *angulatum*, viz., irregular black blotches in anterior angles, submarginal lateral bands continuous with those of abdomen, and two short linear blotches lying inside of the lateral bands which are in this species entirely disconnected from the bands and are but slightly diagonal. Legs pale with distinct narrow black margins on femora and indistinct narrower tibial margins.

Abdomen; segments with one long hair on lateral margin near posterior angle; posterior margin of last segment with hairs composing the delicate fringe unusually long; uncolored to pale golden, with uniform submarginal lateral black bands (more nearly continuous than in *angulatum*, the diagonal sutures and lateral diplacement of the various segmental portions being less marked);

on segments 1–7 a pale brown median blotch, the blotches on segments 4–5 being larger; vulva convex.

Physostomum diffusum n. sp. (Plate lxx, fig. 3.)

One female taken on the Sandwich Sparrow, *Passerculus sandvicensis*, and several males and females taken on the Golden Crown Sparrow, *Zonotrichia coronata* (near Stanford University, Calif.); also two females and a young specimen (variety *pallidum* Kellogg) from a *Junco* sp. (Lawrence, Kansas). This species differs from the preceding two species described in having the lateral abdominal bands distinctly marginal (as is the case with the species of Piaget, Nitzsch, and Denny), and in this it resembles the European species. It has the very long, backward-projecting, occipital angles, as in *angulatum* and *australe*, which is a character shown by but few of the European forms.

Description of female. Body, length 4 mm., width 1.09 mm.; white, with dark brown to black marginal lateral bands on abdomen and thorax, and few black head-markings; the labral lobes large and projecting.

Head, length .8 mm., width .7 mm.; front rather broad, flatly convex, without marginal hairs, sides nearly straight

smoky, occipital margin, indications of occipital bands, and a narrow, indistinct smoky margining of the temples.

Prothorax hexagonal, with anterior and posterior margins weakly concave; in the obtuse lateral angles a hair and two spines; segment white with a narrow submarginal black band, the margin outside of it being more or less suffused with smoky brown. Metathorax with a slight lateral swelling on the lateral margin near the anterior end, bearing a few short pale brown spines; in the posterior angles a single, longish, weak hair; segment white, with a narrow, submarginal, lateral band, outside of which on posterior half of segment the margin is smoky brown. Sternal markings consisting of an intercoxal line, long and curving forward, on metasternum, and two faint median lines on prosternum. Legs, white.

Abdomen. Posterior angles with a single longish hair and a shorter weaker one on lateral margin of each segment of segments 5–8; last segment flatly rounded with two pairs of hairs, and the posterior fringe distinct; dorsal surface without hairs, or with very few; segments white, with broad, black, marginal, lateral bands fading out on eighth segment; indications of narrow, transverse, linear, median blotches at the sutures; under side of abdomen with pale brown, median blotches on segments 5–6.

Var. *pallidum* Kellogg. Two females and a young specimen taken from a *Junco* sp. (Lawrence, Kansas) may be referred to this species but they show varietal differences. The body color is pale golden, the markings are brown, not black, and the middle region of the whole abdomen is pale brownish; of the head markings only the ocular fleck and the bounding blotch on inner rim of the antennal fossa are distinct.

COLPOCEPHALUM.

Colpocephalum chrysophæum n. sp. (Plate lxxi, fig. 1.)

Found on three out of seven specimens of Samuels' Long Sparrow, *Melospiza fasciata samuelis* (Palo Alto, California).

Description of female. Body, length 1.35 mm., width .7 mm.; golden brown with blackish brown bands and margins, and rusty brown transverse blotches.

Head, length .28 mm., width .5 mm.; broadly parabolic in front; one short hair on each side of the middle, then a longer one, then a short one, then a very long one, then two longish ones; the palpi project by at least the last two segments; the ocular emargination is distinct but not acute inwardly; the eye is large, emarginate, and with a distinct black fleck; ocular fringe distinct; temples projecting, rounded, rather narrow, with several long hairs of different lengths, of which two are very long and equal; on the occipital margin of the temples another very long hair and two or three shorter ones; middle part of occipital margin with a few long hairs; head tinged with fuscus with black, curving, broadly linear, ocular blotch and narrow curving transversal black line sub-

especially narrow and distinct, and the curving longitudinal lines beyond the ends are sharply defined and black. Metathorax with posterior margin straight and with about ten longish weak hairs ranged along it; darkest along the short anterior margin and in the latero-posterior angles. Legs pale, with sharply defined marginal markings, especially on the coxæ and on the long slender tibiæ of middle and hind legs. Sternal markings consisting of a small median triangle with linear wings on prothorax, and of black, distinct, angulated, intercoxal lines between meso- and meta-coxæ.

Abdomen ovate, broad at both ends; long hairs in posterior angles of segments, and short hairs, not numerous, on dorsal surface; all segments with a broad, brown, transverse blotch extending entirely across segment, covering almost the whole surface; the sutures, however, are broad and uncolored; lateral bands narrow, black, fading inwardly into the transverse blotches; last segment broad, flatly convex behind, with a fringe of short hairs.

Male. Body, length 1.09 mm., width .5 mm.; head, length .25 mm., width .4 mm.; conspicuously smaller than the female; genitalia extending through segments 5–9, in shape a heavy two-pronged fork.

Colpocephalum osborni n. sp. (Plate lxxi, figs. 2 and 3).

Many specimens, males, females and young, from a White-tailed Kite, *Elanus glaucus* (Palo Alto, California), resembling *C. dissimile* Piaget (Les Pediculines, p. 520, pl. xliii, fig. 4), taken from *Milvus ægyptius* (Museum of Leyden), and *C. tricinctum* Nitzsch (Giebel, Insecta Epizoa, p. 263), taken from *Milvus ater*. Named for Prof. Herbert Osborn of Iowa, who has contributed to the knowledge of American Mallophaga.

Description of male. Body, length 1.31 mm., width

.5 mm.; golden brown, with distinct, broad, black, occipital bands with expanded extremities, and dark brown, transverse, abdominal blotches with black lateral ends.

Head, length .31 mm., width .5 mm.; rather large compared with whole body, just as wide as widest part of abdomen; front broad, flatly rounded, with seven hairs on each side of the median line, four of which are grouped together in front of the ocular emargination; last segment of antenna broad, with slightly concave terminal margin projecting beyond margin of head; ocular emargination pronounced, the deepest point being acutely angled; an ocular fringe; swelling rounded temporal margins, with several hairs of different lengths, three being about equal and longest; occipital margin concave, with four hairs; golden brown, with large black subcircular ocular blotches and triangular occipital blotches connected by the broad, paler (reddish brown) occipital bands; the occipital blotches connected by an even, strongly colored, broad, occipital border; clypeus with two blackish brown blotches connected with the ocular blotches and mandibles by colored areas but little darker than the ground color of head.

Prothorax short, extending laterally even with the outer

broad, transverse, dark chestnut-brown blotch entirely across segment, darkest laterally, with sharp black angulated lateral bands, especially noticeable on segments 3–8; last segment without noticeable blotch, bluntly rounded behind, without numerous hairs.

Female. Body, length 1.47 mm., width .63 mm.; head, length .3 mm., width .5 mm.; with abdomen obovate, tapering posteriorly; abdominal blotches darker laterally but paler in the middle; lateral bands not angulated and wider; last abdominal segment elongate, tapering, with narrow flatly convex posterior margin; segment 8 with a group of seven strong curving hooklike hairs, the posterior ones longest, situated on posterior part of lateral margin of segments; posterior margin of this segment with a series of closely set hairs.

Colpocephalum fumidum n. sp. (Plate lxxi, fig. 5.)

A single specimen from a Least Bushtit, *Psaltriparus minimus* (Palo Alto, California). A strikingly dark *Colpocephalum* showing resemblance to some of the *Colpocephali* of the water birds, such as *uniseriatim* Piaget (Les Pediculines, p. 562, pl. xlvii, fig. 2), from an Avocet, *Recurvirostra avocetta*, rather than to any of the few *Colpocephali* hitherto described from passerine birds.

Description of female. Body, length 2.75 mm., width 1.1 mm.; very dark, smoky, with black occipital margin, ocular blotches, and blackish lateral abdominal bands.

Head, length .5 mm., width .75 mm.; forehead large, flatly rounded in front, with numerous short hairs; two longer hairs in angle in front of ocular emargination; the ocular emargination pronounced, angulated, with the anterior margin of the produced temples almost at right angles to the long axis of the head; the eye prominent, almost if not quite divided, the anterior and larger part

lying in the angle of the emargination, the smaller and posterior part lying apparently on the dorsal surface of the temple; ocular fringe distinct, composed of longish hairs; temporal margins with slightly rounded anterior and posterior angles, and slightly convex lateral margin which bears five longish hairs; occipital margin weakly sinuous and concave, with four hairs; fuliginous with black uneven occipital border; small black ocular blotches, and four small circular uncolored spots on forehead, from each of which arise one or more hairs.

Prothorax with bluntly rounded lateral angles, slightly concave latero-posterior margins, and convex posterior margin, the segment produced backward so as to very materially narrow the median part of the mesothorax, with a spine and a long hair in the lateral angles and two separated hairs on the concave lateral margins, the anterior hair being short and weak. Mesothorax separated from metathorax by an uncolored suture, but with extremely slight lateral emargination; no hairs. Metathorax larger than mesothorax, with straight posterior margin, a spine, a weak hair and a strong hair in posterior angles, and posterior margin not with a marginal series

Colpocephalum flavescens Nitzsch. (Plate lxxi, fig. 4.)

Germar's Mag. Entomol., 1818, vol. iii, p. 298.

Colpocephalum flavescens N., Nitzsch (ed. Giebel) Zeitschr. f. ges. Naturwiss, 1861, vol. xvii, p. 522; Burmeister, Handb. d. Ent., 1835, vol. ii, p. 438; Denny, Monograph., Anoplur. Brit., 1842, p. 206, pl. xviii, fig. 2; Giebel, Insecta Epizoa, 1874, p. 262, pl. xiii, fig. 10; Piaget, Les Pediculines, 1880, p. 515, pl. xlii, fig. 10.

Specimens which should probably he referred to this species from two Bald Eagles, *Haliæetus leucocephalus*, and an American Rough-legged Hawk, *Archibuteo lagopus sancti-johannis* (Lawrence, Kansas). The male figured by me measures: Body, length, 1.5 mm., width, .6 mm.; head, length .31 mm., width .53 mm. The species may be recognized by the strong distinct blotches and occipital bands and border of the head, and the transversal abdominal blotches.

Colpocephalum subæquale Nitzsch. (Plate lxxii, fig. 1.)

Germar's Mag. Entomol., 1818, vol. iii, p. 299.

Colpocephalum subæquale N., Burmeister, Handb. d. Ent., 1835, vol. ii, p. 438; Giebel, Insecta Epizoa, 1874, p. 265, pl. xiii, figs. 13 and 14, Piaget, Les Pediculines, 1880, p. 527.

Two females from an American Crow, *Corvus americanus* (Palo Alto, California). I did not find this species represented on several other crows shot at Palo Alto and at Lawrence, Kansas, although all of the individuals were infested by other parasites, such as *Docophorus atratus* or *Menopon mesoleucum*. My specimens do not have the dorsal surface of the thoracic segments with scattered long hairs, nor the surface of the abdomen thickly beset with hairs, as Giebel's description (Insecta Epizoa, p. 265) records; but neither are these hairs shown in Nitzsch's figure. Nitzsch's specimens were found on *Corvus corax* and *C. frugilegus*. My specimens do not have the first two segments of the abdomen especially lengthened as in Rudow's *semicinctum* (Zeitschr. f.

ges. Naturwiss., 1869, vol. xxxiv, p. 394), from *Corvus scapulatus*. The species may be recognized by the broad black occipital border and occipital bands, ocular and frontal blotches of the head, and by the transverse abdominal blotches of the abdomen, much narrowed in the middle in the male, and divided in the female into a median and two lateral parts. The female figured by me measures: Body, length 1.53 mm., width .63 mm.; head, length .31 mm., width .5 mm.

Menopon decoratum n. sp. (Plate lxxii, fig. 2.)

One male, one female, and a young specimen from a White-tailed Kite, *Elanus leucurus* (Palo Alto, California). A finely marked species not resembling especially any other *Menopon* hitherto taken from birds of prey. No *Menopon* has heretofore been taken from a Kite.

Description of male. Body, length 1.53 mm., width 72 mm.; pale yellowish brown, with dark rusty brown to black markings; distinct transverse bars on abdominal segments, the one on segment 2 especially strongly defined.

Head, length .31 mm., width .66 mm.; robust, more than twice as wide as long; front broad, flatly rounded,

Prothorax irregularly hexagonal, with obtuse lateral angles, and posterior margin flatly convex, with a very obtuse median angle; lateral angles with one very long hair and one shorter one, and a series of eight strong hairs along posterior margin, the terminal hair at each end of the series being exactly in the latero-posterior angle; chitinized tranverse bar in anterior part of segment is weakly colored, and the longitudinal bars at its end are indistinct. Metathorax as short as or slightly shorter than prothorax, wider, with posterior margin straight; two long hairs in posterior angles, and a series of shorter weak ones along posterior margin; anterior angles with strongly colored blotch; an ill-defined, short longitudinal blotch projecting back from converging lateral margins. Legs palely colored.

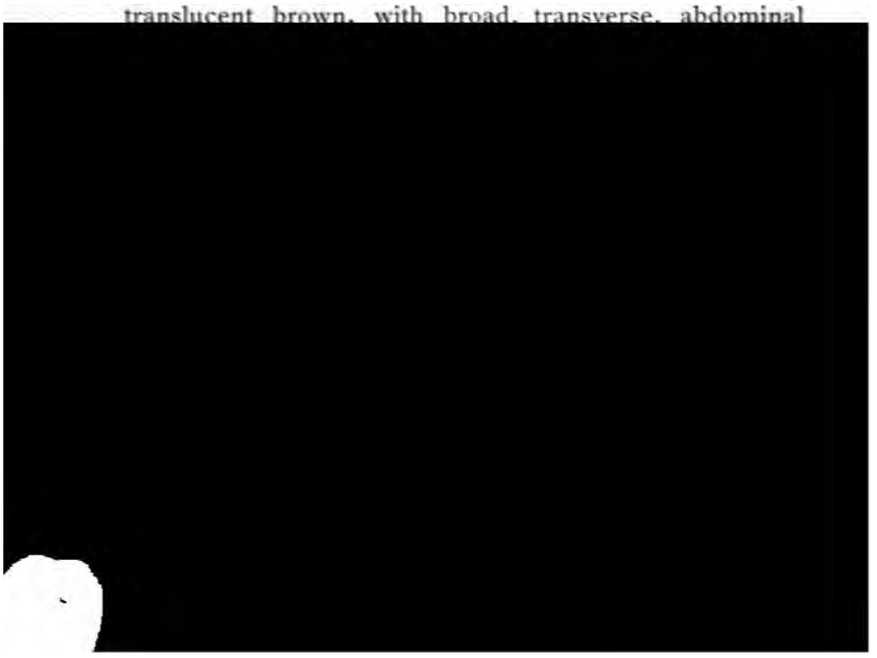
Abdomen broadly ovate, wide and flat behind; posterior angles of segments with two usually long hairs and several short ones; single series of hairs not numerous on dorsal surface; lateral bands blackish brown, broad, interrupted, the segmental portions projecting inward; dark chestnut brown transverse blotches across the segments, with the pale or uncolored sutural bands broad; the colored transverse band of segment 2 is specially strongly marked, and is rather sinuous; last segment with broad, uncolored, posterior border, and with posterior margin straight, with a slight median emargination, and a sparse fringe of hairs of different lengths.

Female. Body, length 2. mm., width .94 mm.; head, length .4 mm., width .7 mm.; perhaps a little darker; the transverse blotches of abdomen better defined; last abdominal segment narrower than in male, and the posterior margin broadly parabolic, with few long, and numerous short hairs.

Menopon robustum n. sp. (Plate lxxii, fig. 3.)

A single specimen found on a Least Bush Tit, *Psaltriparus minimus* (Palo Alto, Calif.). No other specimens of this strange species were found on five other individuals of the same bird species examined. I refer the species to the genus *Menopon*, for it is evidently more closely allied to this genus than to any other one so far established. But it presents a mingling of characters of *Menopon*, *Ancistrona* and *Eureum:* a short broad head with strongly chitinized backward-projecting processes on the ventral surface like *Ancistrona;* a thorax like *Eureum*, and the habitus and general body characters of *Menopon*. If it is to be referred to *Menopon* it ranks with *titan* and *tridens* as anomalous members of the genus, which should be distinguished by subgeneric names, or which should be the provocation for breaking up the already unwieldy genus into several genera. In general shape it resembles *M. subrotundum*, Piaget (Les Pediculines, p. 453, pl. xxxv, fig. 2), from *Gracula sulcirostris*.

Description of the female. Body, length 1.43 mm., width .85 mm.; being thus very broad and short: smoky translucent brown, with broad, transverse, abdominal



divided, and with a distinct fleck; the narrow produced temples with five long hairs of which the hindmost three are very long; occipital margin with six hairs, the two outer ones arising submarginally, no distinct head bands or blotches; the occipital margin narrowly bordered with black; on the under side of the head there are two strongly chitinized, backward-projecting, pointed processes arising from the labium (resembling those, but not bipartite, of *Ancistrona*); these processes show through above and give an appearance of faint occipital bands.

Prothorax very large, as long as the head, and three-fourths as broad, with strong, produced, obtuse, lateral angles; posterior margin obtusely angled on the metathorax; a strong spine and a long hair in each lateral angle, and a not well filled series of weak hairs along posterior margin; the transverse chitin bar distinct, blackish brown, and the curving longitudinal chitin bars at its ends distinct, blackish; no well defined blotches. Metathorax with a few small spines along lateral margins and two longish hairs in posterior angles; posterior margin with marginal series of short hairs (like those of abdomen); regions of latero-posterior angles dark brown, the color extending forward narrowly along the lateral margins. Sternal markings composed of a small median blotch on prothorax, with posterior produced point and lateral linear processes; curving intercoxal lines on mesothorax and short straight ones on metathorax, with a broad pale colored median blotch. Legs concolorous with head and thorax, with coxæ distinctly margined with blackish brown; anterior coxæ with blunt processes about as long as but narrower than the coxæ themselves.

Abdomen more golden or yellowish brown than head and thorax; very broadly elliptical; but slightly turbinated; with two or three rather short hairs in posterior

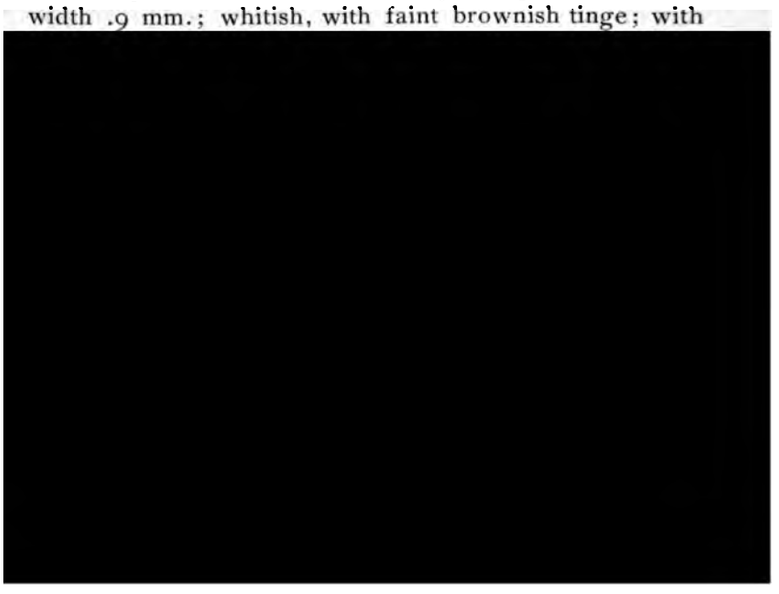
angles; a single transverse series of short hairs along posterior margin of each segment; broad, transverse bands entirely covering each segment; darker at lateral margin, especially on anterior segments; last segment flatly rounded, with fringe of short hairs.

Menopon monostœchum n. sp. (Plate lxxii, fig. 4.)

Specimens from a Silver Pheasant, *Phasianus nycthemerus*, received by the zoological department of this University from Mr. A. C. Robison of San Francisco, California.

The species is like *subæquale*, Piaget (Les Pediculines, p. 463, pl. xxxvii, fig. 5), from *Euplocamus ignitus* in shape of thorax and body, but has only single series of hairs on the abdominal segments (*subæqualæ* has two series on each segment); in the matter of the hairs of the body the new species is like *uniseriatim*, Piaget (Les Pediculines, p. 464, pl. xxxviii, fig. 4) from *Phasianus prælatus*, but differs from this species in not having the posterior margin or prothorax projecting backward and angulated; in both *subæqualæ* and *uniseriatim* the females are smaller than the males (according to Piaget), which unusual condition does not obtain in the new species.

Description of the male. Body, length 2.06 mm., width .9 mm.; whitish, with faint brownish tinge; with



brown ocular blotch; occipital margin narrowly edged with brown; mandibles and adjacent lateral regions dark chestnut brown.

Prothorax with lateral angles narrowly rounded, and with a longish spine; posterior margin curving at sides, but nearly straight on metathorax, and with a marginal series of strong, long hairs; transverse chitin bar pale to uncolored, but distinct, as also the longitudinal bar at its ends. Metathorax of about same length as prothorax, and but very little if at all wider; with five strong, short spines along each lateral margin, and a series of hairs along the straight posterior margin; lateral margins narrowly bordered with blackish brown, and linear brown blotches projecting backward from anterior angles, and tapering and fading out posteriorly. Legs pale, concolorous with body.

Abdomen elliptical, with segments projecting but little laterally; posterior angles with several hairs of different lengths, the hairs longer on posterior segments until on segments 8–9 some of them are very long; lateral bands with short processes projecting inward, one in middle of lateral margin of each segment and one along each suture; no transverse blotches, or only faint indications of brownish color; last segment broad, rounded behind, with numerous long hairs.

Female. Body, length 2.3 mm., width .9 mm.; head, length .4 mm., width .72 mm.; last segment of abdomen more flatly rounded, with a tuft of hair at each posterior angle and a fringe of hairs of equal size along the posterior margin, giving the tip of abdomen a truncate appearance.

Menopon melanorum n. sp. (Plate lxxiii, fig. 1.)

Taken on a Towhee, *Pipilo erythrophthalmus* (Lawrence, Kansas).

Description of female. Body, length 1.37 mm., width .56 mm.; pale golden brown, with black occipital margin of head, blackish brown ocular blotches and mandibles, and brown transverse abdominal blotches distinct only laterally.

Head, length .31 mm., width .47 mm., rather long in comparison with its width for *Menopon;* front rounded, with usual few short hairs in front of barely projecting palpi, and two longish ones in front of ocular emarginations; the emargination distinct, shallow, and with ocular fringe; temples broad, rounded, with a few hairs of different lengths, including at least one very long hair; occipital margin concave, straight in middle, with two longish and two short hairs; occipital margin narrowly but conspicuously bordered with black; indications of widely separated, translucent, occipital bands, convex outwardly; ocular blotches small, narrow, linear, curving, blackish in middle, paling at each end; a small black ocular fleck; a brown spot on margin outside of each mandible, and connected with mandibles by indistinct

of body. Legs concolorous with thorax, with darker indistinct marginal and terminal margins.

Abdomen short, broad, ovate, not turbinated; a single very long hair and a spine in posterior angles of segments; broad, pale brown, transverse bands across all segments but the last, these bands, however, hardly apparent on the middle region of the body, but distinct laterally, the lines of demarcation between pale and darker parts of band rather sharply defined; last segment broad, flatly rounded, uncolored, with a fine fringe of short, uncolored hairs.

Menopon incertum n. sp. (Plate lxxiii, fig. 2.)

Specimens from an American Gold Finch, *Spinus tristis*, and from a Russet-backed Thrush, *Turdus ustulatus* (Palo Alto, California). This is one of these species which might be referred almost indifferently to *Menopon* or to *Colpocephalum*. Because Giebel has referred to a somewhat similar form, *thoracicum* (Insecta Epizoa p. 287) from *Turdus viscivorous*, to *Menopon*, I assign this species to the same genus. The new species differs from *thoracicum* in the hairs of the prothorax, in the straight, not angulated, posterior margin of the mesothorax, in lacking a complete series of hairs along the posterior margin of the metathorax, in the presence of the characteristic spines of the posterior angles of the abdominal segments, and in other particulars. The ocular emarginations of the head are distinct, " fast colpocephalisch," as Giebel says of *thoracicum*.

Description of the male. Body, length 1.16 mm., width .48 mm.; pale brown, with distinct, broad, dark brown, transverse, abdominal bands, and blackish lateral bands; head two-thirds as long as wide.

Head, length .28 mm., width .44 mm.; rather elongate for *Menopon*, with distinct ocular emarginations; rounded

Prothorax short, broad, with produced lateral angles with a spine in each angle, and a series of fourteen strong, sharply pointed hairs along the convex posterior margin; no blotches. Metathorax short, broad; lateral margin with two or three spines, angles with a hair and nearly straight posterior margin with a series of hairs weaker than those of the prothorax. Legs pale, concolorous with body, with short stiff hairs on femora and tibiæ.

Abdomen elliptical, narrow at both ends, with numerous strong hairs in posterior angles of segments and on lateral margins; numerous hairs on dorsal surface; whole abdomen whitish, with narrow, clear, lateral bands, with lateral processes projecting inward from anterior angles of each segment; last segment uncolored, parabolic, with four hairs on posterior margin, two near each end and none in the middle.

Female. Body, length 1.6 mm., width .69 mm.; head, length .31 mm., width .47 mm.; abdomen elongate-ovate, tapering at posterior end, the last segment uncolored, narrowly rounded behind, with a fringe of fine uncolored hairs along posterior margin.

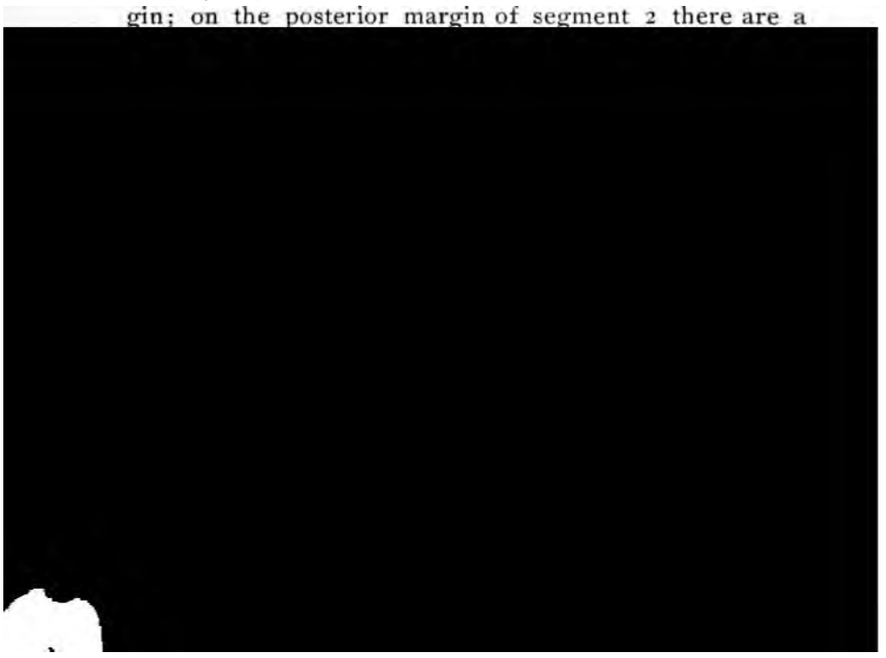
Description of the male. Body, length 1.8 mm., width .62 mm.; pale, clear, yellowish brown, with small black ocular flecks, slightly darker thorax, indistinctly indicated lateral bands, parallel inner logitudinal bands, and numerous short, stiff, spiny hairs on dorsal surface of abdomen.

Head, length .35 mm., width .55 mm.; not so much wider than long as usual in *Menopon;* forehead or region in front of ocular emargination long; front flatly rounded, with a few short hairs and two longish ones, one longer than the other on a slight swelling in front of the ocular emargination; the ocular fringe distinct, composed of curving, stiff hairs; temples with anterior angles somewhat produced, and four long and two or three short hairs on the margin; small black ocular flecks; weakly colored, translucent, narrow, curving, ocular blotches, and a weakly colored region outside of each mandible; occipital margin medially, narrowly, weakly colored, translucent, with two short median hairs and a shorter one at each side of these two.

Prothorax hexagonal, almost as long as broad, the lateral anterior sides short, the lateral angles obtuse, but little produced, with two spines and a short, stiff hair; posterior margin slightly angulated in the middle, and with six longish hairs, the terminal one being in the posterior angles of the segment; whole segment slightly darker than the head, with short, transverse, uncolored, chitin bar. Metathorax with lateral emargination and faint sutural line between meso- and metasegments; lateral margins bare; posterior angles with two spines and the terminal one of a series of submarginal hairs which are ranged along the straight or very weakly convex posterior margin; anterior angles and lateral margin slightly darker, but otherwise the whole segment concolorous with prothorax.

Legs with weakly colored, translucent, dorsal margins on femora and tibiæ; anterior coxæ with bluntly conical processes. Sternal markings ill-defined but apparently composed of longitudinal and transversal narrow bands without median blotches.

Abdomen elongate-elliptical, slightly turbinated, with a strong hair in each posterior angle and a few short hairs along the lateral margins of the segments; dorsal surface with a regular row of short, sharp, spiny hairs on the posterior margin of each segment; on segment 1 no other dorsal hairs; on segment 2 an additional single irregular row across the segment, and on segments 3–8 two additional irregular rows; last segment without rows of short spiny hairs, rounded behind, with four long hairs in lateral groups of two each, and posterior margin with four short, fine hairs; segment 8 has two long conspicuous hairs rising one in the middle of each lateral half of the posterior margin; genitalia of the usual *Menopon* type, an unpaired, long, strong, longitudinal bar with two strong, diverging prongs at posterior angle; ventral surface of abdomen possesses, in addition to transverse rows, groups of short spiny hairs near each lateral margin; on the posterior margin of segment 2 there are a



subtranslucent; metathorax also with distinct dark subtranslucent lateral bands; dorsal surface of abdomen without short spiny hairs, and with a few longer weak hairs arranged in complete transverse rows on segments 1–3, but decreasing in number on posterior segments; last segment with posterior margin rounded about as in male, but with fringe of closely set, short, weak, finely pointed hairs; ventral surface of abdomen with the lateral groups of short spiny hairs as in male.

Menopon mesoleucum Nitzch. (Plate lxxiii, fig. 3.)

Germar's Mag. Entomol., 1818, vol. iii, p. 300.

Ricinus cornicis De Geer, Mem. Ins., 1778, vol. vii, pl. 4, fig. 11.

Menopon mesoleucum N., Burmeister, Handb. f. Ent., 1835, vol. ii, p. 439; Giebel, Zeitschr. f. ges. Naturwiss, 1866, vol. xxvii, p. 119; ibid, Insecta Epizoa, 1874, p. 281, pl. xiv, figs. 11, 12; Piaget, Les Pediculines, 1880, p. 426, pl. xxxiv, p. 7.

A large variety of this species from the American Crow, *Corvus americanus* (specimens from Lawrence, Kansas, and Palo Alto, California). Nitzsch's type-specimens were taken from *Corvus cornix* and *C. corone*. The American specimens are uniformly larger than the type-form (length of *mesoleucum*, male 1.4 mm., female 1.8 mm.; length of var. *americanum*, male 1.7 mm., female 2.12 mm.), and vary from the descriptions of Giebel and Piaget in various particulars.

Var. *americanum* Kellogg. Males, females and young from the American Crow, *Corvus americanus* (Lawrence, Kansas, and Palo Alto, California). Male. Body, length 1.7 mm., width .7 mm.; head, length .34 mm., width .6 mm. Female. Body, length 2.12 mm., width .75 mm.; head, length .37 mm., width .69 mm.

The species may be readily recognized by the marked difference in the sexes, the female having the metathorax produced backward and angulated on the abdomen

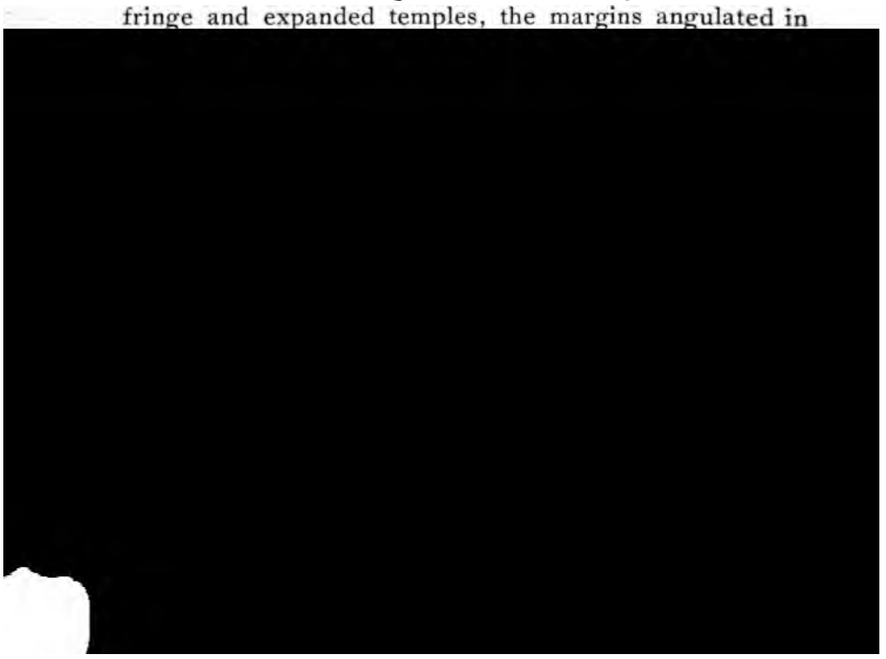
(straight in the male), and with the transverse abdominal blotches of the first three or four segments broken in the middle and the lateral parts projecting diagonally inward and backward; in the male the blotches run evenly across the segments. I figure the male.

Nitzschia dubius n. sp. (Plate lxxiii, fig. 6.)

A few specimens from the Chimney Swift, *Chætura pelasgica* (Lawrence, Kansas). Much like *Nitzschia pulicaris*, Nitzsch, from the European Swift, *Cypselus apus*, but differs in lacking the pustulated hairs of temples and abdomen, and in the shape of the metathorax. The specimens are in poor condition and permit of only an unsatisfactory description.

Body, length 2.22 mm., width .88 mm.; elongate, with narrow neck-like prothorax; expanded posterior portion of abdomen with numerous very long hairs; head, thorax and legs pale, abdomen much darker.

Head, length .41 mm., width .72 mm.; shape of head of *pulicaris*, that is, triangular, with rounded front, a shallow concavity of the margin where the palpi project, a shallow ocular emargination, with conspicuous ocular fringe and expanded temples, the margins angulated in



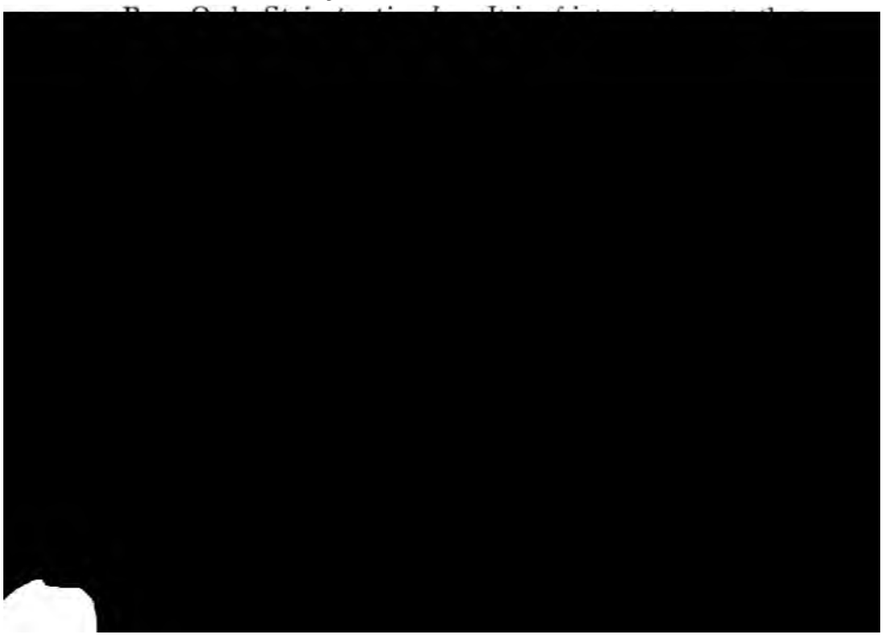
angle with two spines and a hair; posterior angles rounded and the nearly straight, slightly sinuous, posterior margin with six weak hairs; a weakly indicated, uncolored, transverse, chitin bar about even with lateral angles; no distinct blotches. Meso- and metathorax fused, although the line of fusion is marked by a lateral emargination and by an indicated transverse suture; posterior angles of metathorax with two spines and a hair; the straight posterior margin with a submarginal series of short and longer hairs interrupted at the middle; on the dorsal surface of the metasegment six short spines arranged in two diagonal series of three each. Legs long, slender, concolorous with thorax, with fringes of short hairs along dorsal margins of femora and tibiæ. Sternal markings weakly indicated but of the type described as characteristic of *Nitzschia*, consisting essentially of an open quadrilateral without median blotches.

Abdomen widening posteriorly to segment 6; segment 7 a little narrower than segment 6, and segments 8 and 9 narrowing more rapidly; all segments with two to three spines in posterior angles and long hairs, increasing in length and number on posterior segments, those on segments 6–9 being especially long, numerous, and hence conspicuous; segment 9 short, flatly convex behind, with two very long hairs at each end of posterior margin and a sparse fringe of five uncolored hairs along the margin; narrow, translucent, brownish, lateral bands, and the whole abdomen dark, because crossed by broad transverse bands, almost completely covering the surface: posterior margin of each segment with a series of weak hairs.

DISTRIBUTION.

Concerning the distribution of the Mallophaga, I have little to add to the remarks made in my previous paper. Among the land birds of America there are very few which are identical with the Old World species. On those are found parasites identical, or nearly so, with the Old World Mallophaga of the same hosts. On the domestic pigeon, *Columba livia*, I find *Lipeurus baculus* and *Goniocotes compar*, both common on the European individuals of the same host species. In addition, I find a *Menopon* on the pigeon not met with by the European authors. On the Snow Owl, *Nyctea nyctea*, I find *Docophoros ceblebrachys*, described by Nitzsch from the same host. And there are a few other similar examples.

As among the water birds, where I have found previously described Mallophaga on American birds not identical with Old World species, these parasites have been found, almost always, on American birds very closely related to the European hosts. For example, the characteristic *Docophorus rostratus* Nitzsch, of the European Barn Owl, *Strix flammea*, I have found on the American



related to Old World hosts, are presented by *Docophorus communis* and *Nirmus fuscus*. These two parasite species are found, common, in one case, to many passerine birds, and in the other, to several raptorial birds, which differ generically from the Old World hosts. It will be noted, however, that both of these species have a wide range of hosts in both Europe and America. The fact is that we have to do here, in each case, with a group of closely allied, insensibly gradating forms, rather than with a single well marked Mallophagous species. That this condition has been recognized by the European authors is shown in the cases of both *Docophorus communis* and *Nirmus fuscus*, by the attempts which have been made by Giebel and Piaget to break up these species into several distinct species (Giebel), or into subspecies (Piaget).

Finally with regard to the constant or occasional appearance of the parasites on the hosts, I can add also but little. In the preparation of this paper I have had no such long series of specimens of one bird species as it was my privilege to have of certain species of maritime birds. As an illustration of the varying degrees of prevalence of different parasite species infesting a single bird species, the parasites of *Carpodacus mexicanus frontalis*, the House Finch, may be referred to. Of nine specimens of this bird species examined, six were infested by *Docophorus communis*, four by *Nirmus vulgatus*, and one by *Physostomum microcephalum*. Of three specimens examined of the closely related *Carpodacus purpureus californicus*, the California Purple Finch, *Docophorus communis* was found on each, but no *Nirmus* nor *Physostomum* on any. *Physostomum* as a parasite, however, is not always uncommon on its host, as the case of *Physostomum diffusum*, found on five out out of seven specimens of *Melospiza fasciata samuelis*, attests.

Comparing the land birds with the water birds as hosts for Mallophaga, I find that many more individuals among land birds than among water birds are free from parasites, and that among the infested birds the number of individuals of Mallophaga on a single bird individual is much greater among the water bird species than among the land bird species. It is noticeable that the larger land birds such as hawks and grouse show many more parasites than the smaller birds: and to some extent the greater abundance of parasites on water birds may be due to their distinctly larger average size as compared with land birds.

LIST OF HOSTS AND PARASITES.

Colinus virginianus.
  Lipeurus dissimilis.
Callipepla californica.
  Lipeurus docophoroides.
  Goniodes mammillatus.
Phasianus nycthemerus.
  Lipeurus introductus.
  Goniodes cervinicornis.
  Goniocotes creber.
  Menopon monostœchum.

Haliæetus leucocephalus.
  Nirmus discocephalus var. amblys.
  Colpocephalum flavescens.
Bubo virginianus.
  Docophorus cursor.
Nyctea nyctea.
  Docophorus ceblebrachys.
Strix pratincola.
  Docophorus rostratus.

Tyrannus tyrannus.
Physostomum angulatum.
Empidonax difficilis.
Physostomum sucinaceum.
Otocoris alpestris.
Docophorus communis.
Corvus corax sinuatus.
Docophorus distinctus.
Corvus americanus.
Docophorus atratus.
Menopon mesoleucum var. americanum.
Colpocephalum subæquale.
Molothrus ater.
Docophorus transpositus.
Agelaius phœniceus.
Docophorus communis.
Nirmus illustris.
Sturnella magna neglecta.
Docophorus communis.
Icterus bullocki.
Docophorus communis.
Carpodacus purpureus californicus.
Docophorus communis.
Nirmus vulgatus.
Carpodacus mexicanus frontalis.
Docophorus communis.
Nirmus vulgatus.
Physostomum microcephalum.
Spinus tristis.
Menopon incertum.
Spinus psaltria.
Docophorus communis.
Spinus pinus.
Docophorus communis.
Calcarius lapponicus.
Docophorus communis.
Ammodramus sandwichensis.
Docophorus communis.
Physostomum diffusum.
Zonotrichia coronata.
Nirmus vulgatus.
Physostomum diffusum.
Zonotrichia gambeli.
Nirmus vulgatus.
Junco hyemalis.
Docophorus communis.
Nirmus vulgatus.
Physostomum diffusum var. pallidum.
Melospiza fasciata samuelis.
Physostomum diffusum.
Colpocephalum chrysophæum.
Passerella iliaca.
Physostomum angulatum.
Pipilo erythrophthalmus.
Menopon melanorum.
Pipilo fuscus crissalis.
Nirmus vulgatus.
Pipilo maculatus megalonyx.
Nirmus vulgatus.
Cardinalis cardinalis.
Docophorus communis.
Passerina versicolor.
Physostomum australe.
Progne subis.
Docophorus domesticus.
Menopon dissimile.
Petrochilidon lunifrons.
Docophorus excisus var. major.
Nirmus longus.
Tachycineta bicolor.
Docophorus excisus var. major.
Nirmus longus.
Ampelis garrulus.
Docophorus communis.
Ampelis cedrorum.
Docophorus incisus.
Lanius ludovicianus excubitorides.
Docophorus communis.
Harporhynchus rufus.
Docophorus communis.
Psaltriparus minimus.
Colpocephalum fumidum.
Menopon robustum.

Turdus ustulatus.
    Menopon incertum.
Merula migratoria.
    Docophorus communis.
    Nirmus vulgatus.
        simplex.
Sialia sialis.
    Docophorus incisus.

EXPLANATION OF PLATES.

PLATE LX.—Fig. 1, Head of *Colpocephalum flavescens*, under side; *a* labrum, *b* labial palpi, *c* maxillary palpi, *d* antennæ (after Nitzsch). Fig. 2, Maxilla of *Trinotum conspurcatum* (after Nitzsch). Fig. 3, Labium of *Trinotum conspurcatum* (after Nitzsch). Fig. 4, Labium of *Tetropthalmus chilensis* [*Menopon titan*]; *m* mentum, *p l* labial palpus, *g* glossa, *pg* paraglossa, *hy* hypopharynx (after Grosse). Fig. 5, Labium of a *Nirmus*; *g* glossa, *pg* paraglossa (after Grosse). Fig. 6, Head, ventral aspect, with median part of labium cut away, of *Ancistrona gigas*; *lb* labrum, *md* mandible, *l p* labial palpus, *hy* hypopharynx, *f k* labial fork, *a f* antennary fossa. Fig. 7, Labium, ventral aspect, of *Ancistrona gigas*; *s m* submentum, *m* mentum, *p r* labial prong, *p* palpifer, *l p* labial palpus, *lig* ligula, *g* glossa, *pg* paraglossa. Fig. 8, Maxilla of *Ancistrona gigas*. Fig. 9, Right mandible, ventral aspect, of *Ancistrona gigas*; *ten* tendon, *mus* muscle, *v ch r* ventral chitinous rod, *d ch r* dorsal chitinous rod. Fig. 10, Mandibles, ventral aspect, of *Ancistrona gigas*; *c* condyles, *r* right mandible, *l* left mandible. Fig. 11, Hypopharynx of *Ancistrona gigas*. Fig. 12, Left labial fork, ventral aspect, of *Ancistrona gigas*; *mus* muscle.

PLATE LXI.—Fig. 1, Head, ventral aspect, of *Lœmobothrium* sp.; *sm* submentum, *m* mentum, *ant* antenna, *clyp* clypeus, *lb* labrum, *md* mandible, *mx* maxilla, *g* glossa, *pg* paraglossa, *l p* labial palpus. Fig. 2, Mandibles, ventral aspect, of *Lœmobothrium* sp.; *c* condyles, *r* right mandible, *l* left mandible. Fig. 3, Right maxilla, ventral aspect, of *Lœmobothrium* sp. Fig. 4, Labium, ventral aspect, of *Lœmobothrium* sp.; *sm*

aspect, of *Eurymetopus taurus; ant h* anterior horn, *b s* "bonnet string." Fig. 4, Right maxilla, ventral aspect, of *Eurymetopus taurus*. Fig. 5, Mandibles, ventral aspect of *Eurymetopus taurus; c* condyles, *r* right mandible, *l* left mandible. Fig. 6, Labium, ventral aspect, of *Eurymetopus taurus; sm* submentum, *m* mentum, *g* glossa, *pg* paraglossa. Fig. 7, "Lingual gland," ventral aspect, of *Eurymetopus taurus; d* duct, *œ s* œsophageal sclerite, *ch ped* chitinous pedicle. Fig. 8, Left "lingual gland," ventral aspect, of *Eurymetopus taurus; d* duct, *ch ped* chitinous pedicle, *mus* muscle, *l g* the gland.

PLATE LXIII.—Fig. 1, Labium of *Colpocephalum* sp.; *sm* submentum, *m* mentum, *pf* palpifer, *l p* labial palpus, *g* glossa, *pg* paraglossa. Fig. 2, Labium of *Trinoton luridum; sm* submentum, *m* mentum, *pf* palpifer, *l p* labial palpus, *g* glossa, *pg* paraglossa. Fig. 3, Labium of *Nirmus* sp.; *sm* submentum, *m* mentum, *g* glossa, *pg* paraglossa. Fig. 4, Mandibles, ventral aspect, of *Menopon titan; c* condyles, *r* right mandible, *l* left mandible. Fig. 5, Labium of *Physostomum angulatum; sm* submentum, *m* mentum, *pf* palpifer, *l p* labial palpus, *g* glossa, *pg* paraglossa. Fig. 6, Labium of *Nitzschia dubius*; *sm* submentum, *m* mentum, *pf* palpifer, *l p* labial palpus, *g* glossa, *pg* paraglossa.

PLATE LXIV.—Fig. 1, Labium of *Termopsis angusticollis; sm* submentum, *m* mentum, *l p* labial palpus, *g* glossa, *pg* paraglossa. Fig. 2, Maxilla of *Termopsis angusticollis; cd* cardo, *st* stipes, *pf* palpifer, *lac* lacinia, *gal* galea, *mx p* maxillary palpus. Fig 3, Labium of nymph of *Perla; s m* submentum, *m* mentum, *l p* labial palpus, *g* glossa, *pg* paraglossa. Fig. 4, Maxilla of nymph of *Perla; cd* cardo, *st* stipes, *lac* lacinia, *gal* galea, *mx p* maxillary palpus. Fig. 5, Head, ventral aspect, of *Atropos* sp.; *sm* submentum, *m* mentum, *mx* maxilla, *mx p* maxillary palpus, *md* mandible, *clyp* clypeus, *lb* labrum, *g* glossa, *pg* paraglossa, *fk* fork. Fig. 6, Mandibles of *Atropos* sp.; *c* condyles, *r* right mandible, *l* left mandible. Fig. 7, Head, dorsal aspect, of *Atropos* sp.; *clyp* clypeus, *ant* antenna, *œ s* œsophageal sclerite. Fig. 8, Mandible and mandibular muscles of *Psocus* sp.; *f m* flexor muscle, *e m* extensor muscle, *m* molar face of mandible (after Burgess). Fig. 9, Longitudinal section through middle of head of *Psocus* sp.; "*cl* clypeus, *l* labrum, *mand* mandible, the dotted line ending on the ribbed molar surface which tapers beneath into the sharp cutting edge; *mx* maxilla, *t* tongue, *f* fork, *lb* labium and *l p* its palpus, *m* mentum, *l g* lingual gland and *g m* its suspensory muscle, *œ* œsophagus opening below into the oral cavity at the base of which is the œsophageal bone, *œ b*; *f m* flexor muscle of the mandible and *l m* the muscle of the labrum, *c m* muscles of the clypeus, *g l* supra-œsophageal ganglion" (after Burgess). Fig. 10, Labium, posterior aspect, of *Psocus* sp.; "*m* mentum, *lb* labium, *l p* one-jointed labial palpus, behind which one sees the tip of the fork, *f*; *c* cardo, *p* stipes having the four-jointed

maxillary palpus, *m x* lobe; through the mentum can be seen the lingual glands, *l g*, with their duct, *l d*" (after Burgess). Fig. 11, Œsophageal sclerite ("subœsophageal bone"), frontal aspect, of *Psocus* sp.; *l d* duct of the lingual gland (after Burgess).

PLATE LXV.—Fig. 1, *Docophorus taurocephalus* Kellogg, ♂. Fig. 2, *D. alienus* Kellogg, ♂. Fig. 3, *D. incisus* Kellogg, ♂. Fig. 4, *D. domestitus* Kellogg, ♂. Fig. 5, *D. distinctus* Kellogg, ♂. Fig. 6, *D. transpositus* Kellogg, ♀.

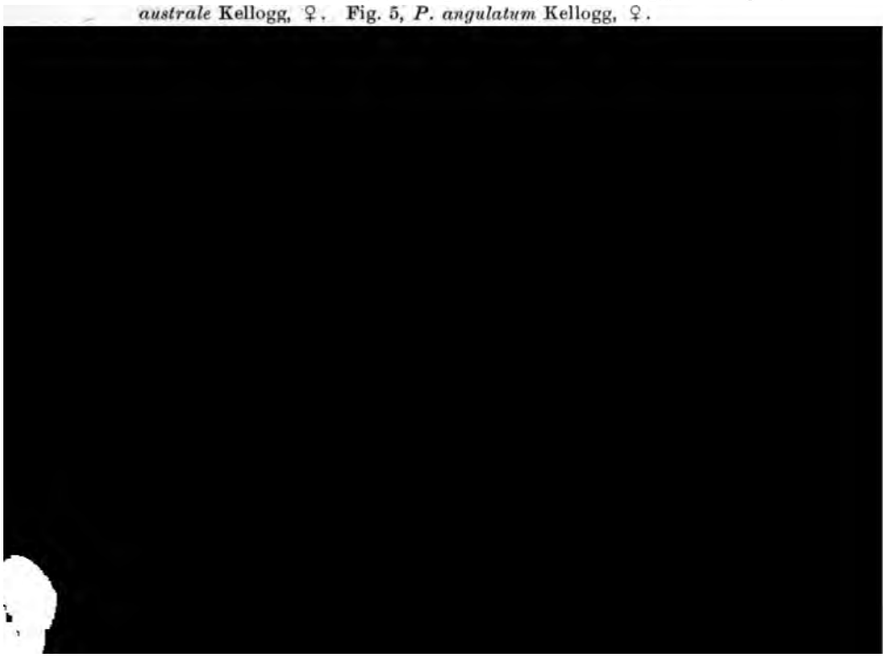
PLATE LXVI.—Fig. 1, *Docophorus cursor* N., ♀. Fig. 2, *D. evagans* Kellogg, ♀. Fig. 3, *D. ceblebrachys* N., ♂. Fig. 4, *D. jungens* Kellogg, ♀. Fig. 5, *D. rostratus* N., ♀. Fig. 6, *D. californiensis* Kellogg, ♂. Fig. 7, *D. communis* N., ♀.

PLATE LXVII.—Fig. 1, *Nirmus longus* Kellogg, ♀. Fig. 2, *N. simplex* Kellogg, ♀. Fig. 3, *N. eustigmus* Kellogg, ♀. Fig. 4, *N. illustris* Kellogg, ♂. Fig. 5, *N. vulgatus* Kellogg, ♀. Fig. 6, *N. discocephalus* var. *amblys* Kellogg, ♀. Fig. 7, *N. fuscus* N., ♀.

PLATE LXVIII.—Fig. 1, *Lipeurus introductus* Kellogg, ♀. Fig. 2, *L. snodgrassi* Kellogg, ♀. Fig. 3, *L. macrocephalus* Kellogg, ♀. Fig. 4, *L. baculus* N., head of ♂. Fig. 5, *L. introductus* Kellogg, head of ♂. Fig. 6, *L. baculus* N., ♀. Fig. 7, *L. dissimilis* P., head of ♀. Fig. 8, *L. docophoroides* P., ♀.

PLATE LXIX.—Fig. 1, *Goniodes cervinicornis* G., ♀. Fig. 2, *Goniodes mammillatus* Rudow, ♀. Fig. 3, *Goniocotes creber* Kellogg, ♀. Fig. 4, *Goniocotes compar* N., ♂.

PLATE LXX.—Fig. 1, *Physostomum microcephalum* Kellogg, ♀. Fig. 2, *P. sucinaceum* Kellogg, ♀. Fig. 3, *P. diffusum* Kellogg, ♀. Fig. 4, *P. australe* Kellogg, ♀. Fig. 5, *P. angulatum* Kellogg, ♀.



LIST OF FISHES COLLECTED AT PORT LUDLOW, WASHINGTON.*

BY EDWIN CHAPIN STARKS.

(With Plates lxxiv and lxxv.)

This paper records the ichthyological results of the last annual dredging expedition made by the Young Naturalists' Association of Seattle, Washington, and the second in which the author, as an honorary member, has taken part. A camp was established this year near Port Ludlow, on Puget Sound, and all the dredging and other collecting was done in that vicinity.

The report of last year† recorded 141 species known from that region. Five new species and four others hitherto unrecorded are listed in the present paper.

The author wishes to express his indebtedness to Dr. Charles H. Gilbert, whose interest and aid made his work possible.

The following species are described here as new to science. The number after each is the number of the type on the register of the Leland Stanford Jr. University Museum. The new genus is indicated by full face type.

Neoliparis fissuratus. No. 5044.
Artedius asperulus. No. 5046.
Axyrias *harringtoni.* No. 5047.
Icelinus strabo. No. 5045.
Pallasina aix. No. 5040.

Family SQUALIDÆ.

1. **Squalus sucklii** (Girard).

*Contributions to Biology from the Hopkins Seaside Laboratory of the Leland Stanford Jr. University, No. 8.

†"The Fishes of Puget Sound," Jordan & Starks, Proc. Cal. Acad. Sci., 2d Ser., Vol. v, 1895.

Family RAJIDÆ.

2. **Raja binoculata** (Girard).

Family AMMODYTIDÆ.

3. **Ammodytes personatus** (Girard).

Hundreds of this species were found on the beach one morning at low tide.

Family SPHYRÆNIDÆ.

4. **Sphyræna argentea** (Girard).

Rather rare this far north, but not infrequently taken by the fishermen. Specimens are in the collections of the Young Naturalists that were taken in the vicinity of Seattle.

Family AULORHYNCHIDÆ.

5. **Aulorhynchus flavidus** Gill.

Very common. Several specimens taken with the seine from among the "eel grass."

Family GASTEROSTEIDÆ.

Family EMBIOTOCIDÆ.

9. **Cymatogaster aggregatus** Gibbons.

Family SCORPÆNIDÆ.

10. **Sebastodes caurinus** (Richardson).

Family HEXAGRAMMIDÆ.

11. **Hexagrammus asper** Steller.

12. **Ophiodon elongatus** Girard.

Family COTTIDÆ.

13. **Chitonotus pugettensis** (Steindachner).

One specimen dredged.

14. **Icelinus strabo** Starks n. sp.

Head 2¾ in body; depth 4; D. IX–15; anal 13; eye 4 in head; maxillary 2⅝; snout 4.

Body robust at shoulders, tapering into a rather slender caudal peduncle; upper profile of head evenly curved from snout to dorsal, the snout rather steep; mouth horizontal and placed at the extreme lower aspect of head; upper jaw projecting slightly beyond the lower; narrow bands of villiform teeth on jaws, vomer, and palatines; maxillary reaching about to posterior margin of eye.

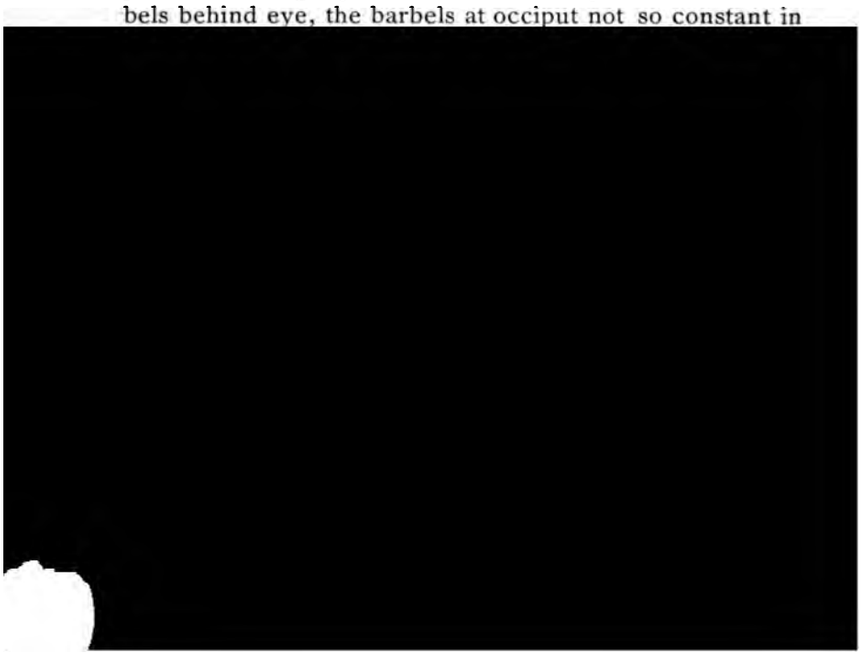
Nasal spines prominent; upper spine of preopercle longer than eye, extending upward and backward, and bearing on its inner edge one or two antler-like processes; below it on edge of preopercle are two small spines, the upper rather blunt and not conspicuous, the lower longer and sharp, pointing downward and somewhat forward; on each side of occiput is a small blunt tubercle, a short dermal flap behind each eye, and one sometimes present behind each occipital tubercle.

Head naked; a band of scales along back, following dorsal outline, composed of two rows of scales for most of its length, but the posterior five or six scales are in a single row; the outer and anterior edge of each scale is embedded, the inner and posterior edge is strongly ctenoid, so the opposing edges of the rows are ctenoid edges; a single row of 37 scales along lateral line, the anterior ones rougher than the others.

Dorsal spines slender, the fins not connected; front of anal slightly nearer tip of snout than base of caudal; pectorals rather wide, reaching a little past front of soft dorsal.

Color olive-gray, with faint irregular darker cross-bars on back, the first under middle of spinous dorsal, the second under first fourth of soft dorsal, the third under last fourth of soft dorsal, indications of one on caudal peduncle, and a dark streak at base of caudal fin; sides and back mottled, under parts white; ventrals and anal white, other fins crossed with dark wavy lines,

This species is closely related to *Icelinus borealis*, differing from it in having a smaller eye, a stouter caudal peduncle, a slightly wider interorbital space, shorter barbels behind eye, the barbels at occiput not so constant in



15. **Triglops beani** Gilbert.

One specimen dredged.

16. **Artedius asperulus** Starks n. sp.

Head 2¾ in body; depth 4; D. IX–16; A. 12; eye 4 in head; maxillary 2⅓; snout 4.

Profile of head broadly rounded from tip of snout to occiput, the snout very steep; lower outline of head nearly horizontal, mouth at lower aspect of head little if any oblique; maxillary reaching to below middle of eye; villiform teeth on jaws, vomer, and palatines; nasal spines prominent, preopercular process short, bifurcate, the entire spine covered with skin; three small spines developed on edge of preopercle below it; top of head naked, with many mucous pores; interorbital space narrow, concave, its width about half eye. A wide band of strongly ctenoid scales along back, starting opposite front of spinous dorsal, and below it a distance equal to pupil, gradually running upward and nearly touching the base of soft dorsal, joining its fellow of the opposite side behind dorsal, and continuing on caudal peduncle to midway between last ray of dorsal and base of caudal; at its widest part, under front of soft dorsal, it is 9 scales wide in an oblique series; 33 oblique series in its length; lateral line armed with 35 ctenoid scales in a single series; all the scales are imbedded on their lower anterior edges and ctenoid on their upper posterior edges; naked area between lateral line and band of scales, at its widest part narrower than band of scales. Spinuous dorsal rounded in outline, not joined to soft dorsal; pectoral reaching to base of seventh or eighth ray of soft dorsal; ventrals reaching vent.

Color olive-brown, with four or five dark, irregular cross-bars on back, which break up and form reticula-

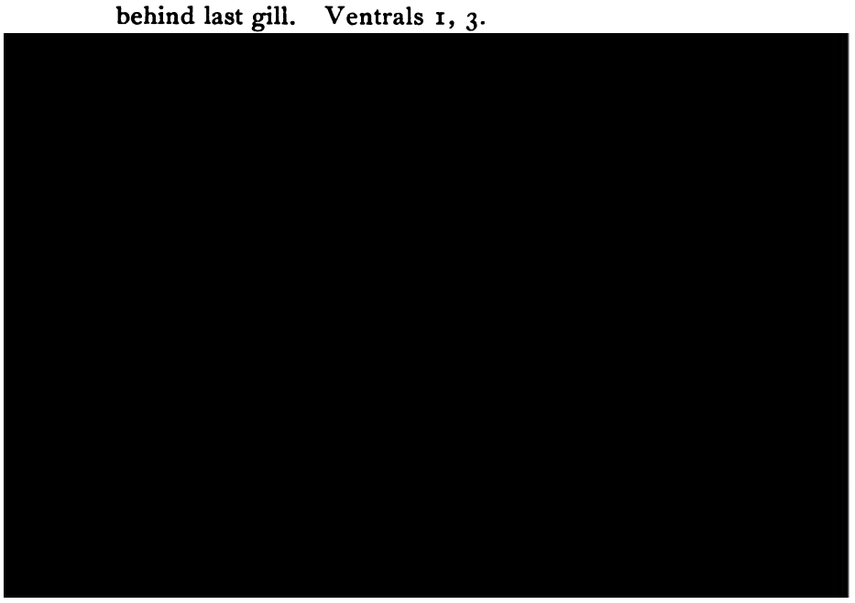
tions around white spots on sides; the lower of these spots form semicircles only where they run into the white of the belly. The first cross-bar is under front of spinous dorsal, the second is under front of soft dorsal, the third under posterior third of soft dorsal, the fourth indicated by a blotch on caudal peduncle; a dark streak at base of caudal fin; under parts white; ventrals and anal white, other fins crossed with undulating lines; lips dusky.

This species differs from *Artedius lateralis*, with which it seems to be most closely related, in having a wider and longer band of scales, and in other less important characters.

The types are three specimens about an inch and a half in length, which were dredged in the vicinity of Port Ludlow. They are in the museum of the Leland Stanford Jr. University, No. 5046.

Axyrias n. gen.

Top of head with patches of ctenoid scales and cirri. A band of very small scales below dorsals, and a single row of larger ones following the lateral line. Villiform teeth on jaws, vomer, and palatines. Preopercular spine short, very narrowly forked. Dorsals not connected. Gill-membranes united, free from the isthmus. No slit behind last gill. Ventrals 1, 3.

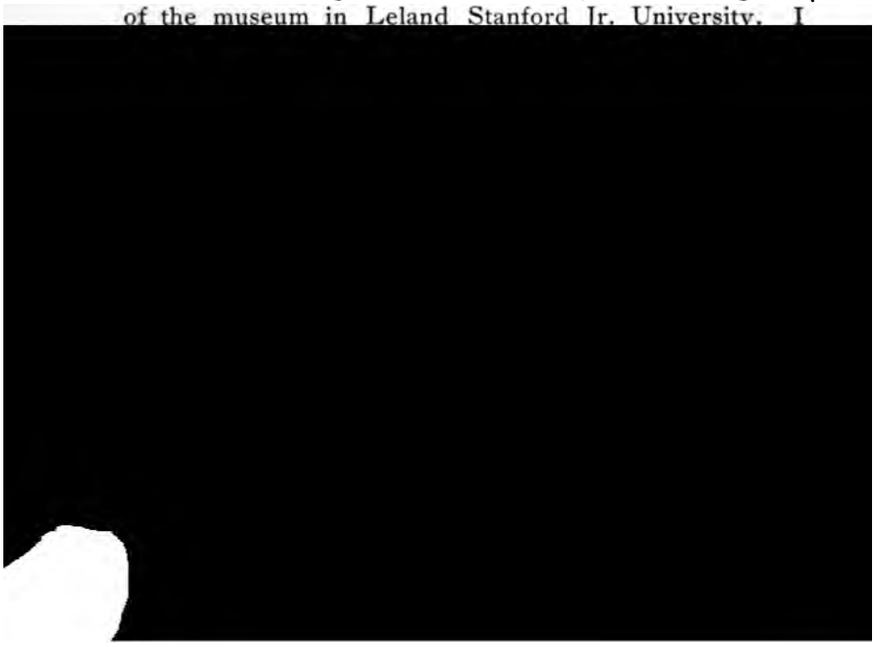


Upper profile of head steep from tip of snout to above eyes, thence nearly horizontal; mouth at lower aspect of head, the jaws subequal; maxillary reaching to the vertical from pupil; villiform teeth on jaws, vomer, and palatines; eye set high in head, its diameter a little less than length of snout; interorbital space nearly concave, its width about half eye; upper preopercular spine short, its length about a third of eye, very narrowly bifurcate at tip, the forks very small; below it on edge of preopercle is a second spine, small and blunt, and a third scarcely developed; nasal spines prominent. Top of head and upper part of opercles with patches of ctenoid scales, a patch on posterior part of interorbital space and behind eyes, sending a narrow band backwards along each side of head above opercles, and a few in front of dorsal, leaving a seminaked area in front of occiput, which has a few scales scattered over it. Many cirri on top of head scattered among the scales, one above posterior edge of each eye, one over anterior edge of eye, two or three around edge of preopercle, one on end of maxillary, and one at each anterior lateral scale back to about middle of lateral line. A band of rough scales along back, about 7 scales wide anteriorly, and composed of about 47 oblique series; the scales obliquely imbedded, the upper posterior edges strongly ctenoid, the lower anterior edges imbedded. A naked area of nearly the same width as band between it and spinous dorsal, the band running upwards posteriorly and touching second dorsal at about its middle, running back and joining its fellow of the opposite side behind the second dorsal, and ending midway between base of last ray and base of caudal; a single row of 36 scales similar to the others following lateral line. Dorsal spines subequal from the first to the sixth or seventh, the fin not connected with soft dorsal,

which is about the same heighth as the spinous; pectoral rather large, reaching to the base of fourth or fifth dorsal ray; ventrals scarcely reaching vent; insertion of anal midway between middle of eye and base of caudal, its longest ray about equal to those of dorsal.

Ground color olive, with about five dark cross-bars on back; the first bar under middle of spinuous dorsal, the second under front of soft dorsal, the third under its middle, and the fourth under its end, and the fifth is represented by a blotch on top of caudal peduncle; a dark streak at base of caudal fin; sides with many clear-cut, round, white spots, growing larger downwards; the lower row are only half spots where the white of the spot runs into the white on lower part of body; belly white; lips and under parts of head with dark olive-brown wavy bars of about the same width as the interspaces; fins with wavy dark streaks, except anal and ventrals which are white. Coloration very similar to *Artedius lateralis*.

The single type specimen was taken with the dredge in the vicinity of Port Ludlow. It is about two and a half inches in length. Numbered 5047 on the register of the museum in Leland Stanford Jr. University. I



The following is the fin formula of our specimens:

	1 specimen.	1 specimen.	6 specimens.	4 specimens.
Dorsal	viii—13	viii—14	ix—13	ix—13
Anal	11	11	11	12

	2 specimens.	3 specimens.	1 specimen.	1 specimen.
Dorsal	ix—14	ix—14	x—13	x—13
Anal	11	12	11	12

20. **Enophrys bison** (Girard).

21. **Leptocottus armatus** Girard.

22. **Oligocottus embryum** Jordan & Starks.

A few specimens were taken in the rock pools. The color was found very variable, as in related species, running from a grass green without distinct markings to those that are mottled and barred, as described in original description.

23. **Oligocottus borealis** Jordan & Snyder.

Very abundant in tide pools.

24. **Nautichthys oculofasciatus** (Girard).

A few specimens taken in the dredge.

25. **Blepsias cirrhosus** (Pallas).

Very abundant in the "eel grass," where specimens were secured.

26. **Ascelichthys rhodorus** Jordan & Gilbert).

A large specimen found under a rock on the shores of

Mats Mats Bay, and a small one dredged from moderately deep water.

Family PSYCHROLUTIDÆ.

27. Psychrolutes paradoxus Günther.
(*Psychrolutes zebra* Bean.)

First recorded last year from this locality, where a single small specimen was dredged. This year it was found to be extremely abundant, and was taken with the seine and dredge.

According to Dr. Boulenger, the original type of *P. paradoxus* agrees perfectly with our figure of *P. zebra*, and the two are not distinct.

Family RHAMPHOCOTTIDÆ.

28. Rhamphocottus richardsoni Günther.

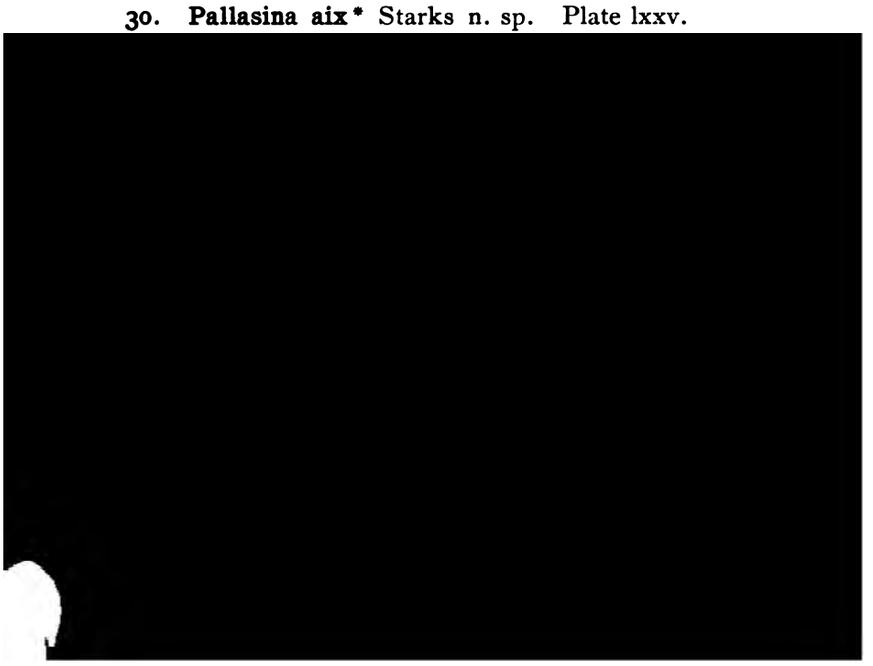
A few small specimens taken with the dredge.

Family AGONIDÆ.

29. Aspidophoroides inermis Günther.

One specimen dredged.

30. Pallasina aix* Starks n. sp. Plate lxxv.



making the interorbital space deeply concave; width of the latter about two-thirds eye; two ridges from the inner edges of supraorbital rim run backward, and are continuous with dorsal ridges of body; edge of preopercle with three spines, the middle one the largest. Two large median plates in front of ventrals on breast, a row of plates along each lateral ridge of breast, a large plate on each side of the union between first and second median plates, and behind them a row of small plates irregular in size and position, sometimes continuous and interposed between median and lateral plates, and sometimes allowing the edges of median and lateral plates to touch; 11 or 12 plates in front of dorsal; spinous dorsal on 9 or 10 plates, counting to end of membrane; lateral line 43. Space between dorsal ridges strongly concave, the ridges coming together on caudal peduncle but not uniting, continuing parallel for a short distance and then becoming obsolete; upper lateral ridge ending anteriorly on about the twelfth plate from head. Last rays of dorsal and anal connected to the body by a membrane; space between dorsals about equal to the width of a plate; front of anal midway between posterior end of maxillary and base of caudal; pectoral reaching just past front of spinous dorsal; vent distant an eye's diameter from base of ventrals; length of caudal equal to head behind anterior ridge of pupil.

Color blackish, with fine punctulations; belly white; a light streak running backward from eye to upper edge of gill-opening; below this an area scarcely so wide as eye, darker than the rest of body, its lower edge sharply defined against the white under parts of head; chin black; dorsals and caudal dusky; pectorals light, the rays with many black spots which do not involve the membrane; ventrals and anal white.

This species differs from *Pallasina barbatus* in having a much shorter barbel on chin, in having two median plates in front of ventrals in place of three, and in having the plates between the median and lateral plates much smaller and less regular in arrangement. In *P. barbatus* these plates are about as large as the median plates and always interposed between them and lateral plates, the arrangement being constant. The abdominal ridges are generally closer together in *P. aix* than in the northern species.

This species was taken with the seine in great abundance in Puget Sound, near Port Ludlow; the largest is nearly five inches in length, the others about three.

This type has been given the number 5040 on the register of the collection in the Leland Stanford Jr. University Museum.

31. **Podothecus acipenserinus** (Pallas).

Two small specimens obtained in the seine.

32. **Averruncus emmelane** Jordan & Starks.

A fine large specimen taken with the seine.

33. **Xystes axinophrys** Jordan & Starks.

Body moderately elongate, not produced at nape; mouth rather large, the maxillary extending to below middle of eye; jaws subequal; teeth tricuspid, arranged in about 10 oblique series in each jaw; nostrils ending in short wide tubes; gill-openings wider than in any other known *Neoliparis*, commencing a distance above pectoral about equal to the diameter of eye, ending about opposite the fourteenth ray; ventral disk a little longer than wide, its distance from chin equal to one and a half its longest diameter, its posterior edge about the same distance from front of anal; vent nearer anal than ventral disk, its distance from anal equal to half ventral disk. Origin of spinous dorsal at the vertical from midway between vent and ventral disk; dorsal scarcely joined to caudal, anal very slightly; front of anal nearer chin than base of caudal by a distance equal to ventral disk; pectoral rather short and wide, reaching to opposite front of anal, the lower lobe very narrow and long, much longer than upper lobe, but not reaching so far posteriorly on account of the oblique position of the fin; tip of lower lobe reaching to vent; length of caudal $1\frac{3}{5}$ in head.

Color dusky, darker above, sides with five punctulations, belly and under parts of head except chin white; lips dusky; dorsals and anal darker than body; pectoral dusky at base, the lower lobe dark; caudal crossed with wavy dark lines.

This species differs from the other species in this genus in having a wider gill-opening, and in minor characters.

The single type specimen was taken with the dredge, in the vicinity of Port Ludlow; it is $2\frac{1}{4}$ inches in length. It bears the number 5044 on the register of the Leland Stanford Jr. University collection.

36. Liparis dennyi Jordan & Starks.

One specimen dredged.

37. **Liparis fucensis** Gilbert.
Three specimens dredged.

38. **Liparis pulchellus** Ayres.
Three small specimens taken with the dredge.

Family GOBIESOCIDÆ.

39. **Caularchus mæandricus** (Girard).

Family XIPHIDIONTIDÆ.

40. **Pholis ornatus** (Girard).

41. **Apodichthys flavidus** Girard.
Obtained in great abundance with the seine from among the *Fucus*. No specimens seen in the rock pools.

42. **Anoplarchus atropurpureus** (Kittlitz).

43. **Xiphistes chirus** Jordan & Gilbert.

44. **Xiphidion rupestre** (Jordan & Gilbert).

45. **Xiphidion mucosum** Girard.

Family STICHÆIDÆ.

46. **Lumpenus anguillaris** (Pallas).

NOTE ON EMMYDRICHTHYS VULCANUS.

BY DAVID STARR JORDAN.

Professor J. T. Wallace, of California College, Oakland, has just furnished some additional information concerning *Emmydrichthys vulcanus*, a species of fish described in the early part of this volume (page 221), and figured on plate xxvi.

Professor Wallace writes:

"I received a letter from Rev. J. W. Henry, who presented us the *Emmydrichthys vulcanus*, a few weeks ago, in which he gave me some further description of this rare fish. He says it is a rare fish, even in Tahiti. It nearly always burrows in the sand, raising a little mound over itself, and is thus the more dangerous to the native fishermen, who usually go barefoot and are quite liable to step on these dangerous hidden fish. He thinks it is a rare case for any one to recover from the terrible wound of these poisonous spines—generally dying from lockjaw. He corrects the name as we all read it on the jar, saying the natives call it the "No-hu." In the published account in No. VI, p. 223, you have probably noticed the mistake, Hawaiian instead of the Society Islands."

The type of *Emmydrichthys vulcanus* has been transferred to the museum of Stanford University.

PROCEEDINGS.

January 20, 1896.—STATED MEETING.

The PRESIDENT in the chair.

Rabbi Jacob Voorsanger and Rufus L. Green were proposed for membership.

Leverett M. Loomis, Curator of the Department of Ornithology, delivered a lecture on "Alexander Wilson, the Poet Naturalist, the Father of American Ornithology."

February 3, 1896.—STATED MEETING.

The PRESIDENT in the chair.

A. C. Lawson and M. W. Haskell were proposed for membership.

Donations to the Museum were reported from Joseph Mailliard, F. Kano, and J. D. Galloway.

Additions to the Herbarium were reported from T. S. Brandegee, O. T. Baron, and Carl Purdy; also 1,100 plants from Utah, by purchase from Marcus E. Jones.

Additions to the library:

From correspondents	199
By purchase	523
By donation	13
By exchange	1

Professor Joseph Le Conte read a "Memoir of James Dwight Dana, the Great Geologist."

February 17, 1896.—STATED MEETING.

The PRESIDENT in the chair.

Rabbi Jacob Voorsanger and Rufus L. Green were elected resident members.

Julius Callandreau, C. L. Cory, W. G. Curtis, W. R. Eckart, J. N. Le Conte, and F. W. Scaife were proposed for membership.

Mr. E. J. Molera delivered a lecture "On the Sources of Information of the History of the Aztecs, and the Latest Discovered Aztec Codex," illustrated with stereopticon views.

March 2, 1896.—STATED MEETING.

VICE-PRESIDENT RITTER in the chair.

E. L. Grossman was proposed for membership.

Donations to the Museum were reported from George A. Stabler, William Brewster, J. S. Cooper, G. W. Stewart, and J. B. Warren.

Additions to the Herbarium were reported from the U. S. Dept. of Agriculture collections in Alaska, from Baron F. von Mueller, Alvah Eaton, and F. W. Koch; also 425 specimens collected by C. G. Pringle in Mexico in 1894, purchased by the Curator and the Botanical Club.

Additions to the Library:

From correspondents	135
By purchase	46
By donation	14

Notice was given that the following communication had been presented to the Council and received the sanction of that body:—

"*To the President of the Council of the California Academy of Sciences:*

"SIR—The undersigned have united to form a section of this Academy to be called 'Section of Exact and Applied Sciences,' for the purpose of creating an interest in those branches of Science amongst the members of our Institution.

"The undersigned respectfully ask the approval of the Council of the Academy to form said section, and that due notification thereof shall be made to the Academy, in conformity with the prescriptions of its By-Laws.

[Signed] "GEORGE DAVIDSON,
"E. J. MOLERA,
"H. C. BEHR,
"HERMANN KOWER."

March 16, 1896.—STATED MEETING.

The PRESIDENT in the chair.

The following resolutions were presented and unanimously adopted:

Be it resolved by the California Academy of Sciences:—

First—That the California Academy of Sciences is in full accord with the Sierra Club of California in its opposition to all movements looking toward the reduction in area of the United States forest reservations in California and neighboring States.

Second—That a copy of this resolution be sent to Honorable Hoke Smith, Secretary of the Interior.

The President announced, at the request of Dr. Joseph Le Conte, that steps had been taken to establish a Huxley Memorial, and that donations would be received by Dr. Le Conte or the Assistant Secretary of the Academy.

The President made a statement of the financial condition of the Academy.

Vice-President Ritter, on behalf of the Council, presented the following, which was unanimously adopted:—

WHEREAS, So largely are the prosperity and happiness of the people of our country dependent upon the products of the soil, and so largely do the extent and profitableness of t hese products depend upon the degree of scientific knowledge with which agriculture is pursued, that any measure which will increase the amount and efficiency of such knowledge ought to receive the heartiest support of the whole people; and

WHEREAS, It appears that such a measure is that now before the Congress of the United States proposing to create the office of "Director-in-Chief of Scientific Divisions" in the National Department of Agriculture, the position to be filled by a person whose selection and tenure of office shall be determined solely by his scientific and business qualifications; therefore be it

Resolved, That the California Academy of Sciences heartily approves the proposition.

Professor Fernando Sanford delivered a lecture entitled "Cathode Radiation," with illustrations.

April 6, 1896.—STATED MEETING.

The PRESIDENT in the chair.

M. W. Haskell, A. C. Lawson, F. W. Scaife, W. G. Curtis, W. R. Eckart, C. L. Cory, J. N. Le Conte, Julius Callandreau, and E. L. Grossman were elected resident members.

Harold W. Fairbanks, W. L. Jepson, and Beverly Letcher were proposed for membership.

Donations to the Museum were reported from L. Belding and S. Grozelier.

Additions to the Herbarium were reported from M. A. Howe, Carl Purdy; Agricultural Experiment Station, Pullman, Washington; Mrs. Elwood Cooper, L. Jared, C. F. Sonne, and Mrs. L. Trask; also 160 Hawaiian plants purchased by the Curator.

Additions to the Library:

From correspondents	152
By purchase	65
By donation	9

Dr. Frank Angell delivered a lecture entitled "Realities, Illusions, and Hallucinations."

April 20, 1896.—STATED MEETING.

The PRESIDENT in the chair.

Mr. Charles A. Keeler delivered a lecture on "Natural Selection and Heredity."

May 4, 1896.—STATED MEETING.

VICE-PRESIDENT RITTER in the chair.

Professor Bernard Moses read a paper on "The Economic Aspect of Spanish Rule in America."

Additions to the Library:

From correspondents.....186
By purchase.....38
By donation.....1

Professor John C. Merriam delivered a lecture on "Human Remains of the Later Geological Periods."

June 15, 1896.—STATED MEETING.

VICE-PRESIDENT BEHR in the chair.

P. W. Nathan, George W. Dickie, Irving Stringham, and John Richards were proposed for membership.

July 6, 1896.—STATED MEETING.

VICE-PRESIDENT RITTER in the chair.

H. W. Fairbanks, Beverly Letcher, C. E. Grunsky, and W. L. Jepson were elected resident members.

Donations to the Museum were reported from J. H. Henderson, George A. Treadwell, Gustav Eisen, D. Van Denburgh, C. A. Purpus, M. Braverman, Maurice Chaper, and F. Billa.

Donations to the Department of Ornithology:

Specimen of Great Northern Diver (*Urinator imber*), from San Francisco Bay.

Additions to the Herbarium were reported from E. O. Wooten, of the Agricultural College, Las Cruces, New Mexico, Dr. Lorini, and C. H. Thompson; also, in exchange, 298 specimens collected in Missouri, from J. W. Blankinship, of Harvard Botanical Garden.

Additions to the Library:

From correspondents.....346
By purchase.....85
By donation.....7

The following message of congratulation, sent on the occasion of the celebration of the fiftieth anniversary of the professorship of Lord Kelvin, of the University of Glasgow, Scotland, was read by the Secretary; also the reply to the message by Lord Provost of the city:

"The California Academy of Sciences sends greetings to your noble city; congratulations to your great University; and tribute of respect to Scotland's most distinguished citizen, Lord Kelvin.

"DAVID STARR JORDAN, *President*,
"JAMES O'B. GUNN, *Corresponding Secretary*.

"To Lord Provost of Glasgow, Scotland."

"On behalf of the University and City of Glasgow I gratefully thank you for your congratulations to our noblest citizen, which I have gladly conveyed. "LORD PROVOST."

It was moved by the Secretary and seconded by Mr. Molera, that the thanks of the Academy be tendered to the Postal Telegraph and Commercial Cable Co., and to Mr. L. M. Scarrow, Superintendent, for gratuitously transmitting the message of congratulation from the Academy to Lord Kelvin.

Unanimously carried.

Messrs. Chas. A. Keeler and William E. Ritter, appointed to draw up resolutions upon the death of Mr. Vaslit, presented the following:—

WHEREAS, The Members of the California Academy of Sciences, having learned with deep regret of the death of one of its life members, Frank H. Vaslit, who has served for the past seven years in the capacity of Assistant Secretary and Librarian,

Resolved, That in the death of Mr. Vaslit the Academy recognizes that it has lost not only an unusually faithful and efficient servant, but also a member of sterling personal worth.

Resolved, That we express to his relatives our appreciation of his services and tender them our sincere sympathy.

Resolved, That a copy of these resolutions be spread upon the minutes of the Academy.

Second Vice-President Behr was called to the chair, while Vice-President Ritter spoke on the Geographical Distribution of Batrachians, followed by Miss Alice Eastwood on plants.

August 3, 1896.—STATED MEETING.

Additions to the Library:

From correspondents.....190
By purchase.....60
By donation.....6

The subject of the previous meeting, "Geographical Distribution of Life in California," was concluded; John Van Denburgh speaking on reptiles, and Charles A. Keeler on birds.

September 7, 1896.—STATED MEETING.

VICE-PRESIDENT RITTER in the chair.

R. M. Hills, E. W. Hilgard, and Charles P. Grimwood were elected resident members.

John L. Howard was proposed for membership.

Donations to the Department of Ornithology were reported from H. R. Taylor.

Additions to the Herbarium for July and August consisted of 828 specimens by exchange and donation.

Additions to the Library:

From correspondents.....180
By purchase.....53
By donation.....12

Dr. William Pepper, President of the Museum of the University of Pennsylvania, delivered an address entitled "The Function of the Museum in Modern Communities."

September 14, 1896.—SPECIAL MEETING.

VICE-PRESIDENT RITTER in the chair.

Dr. Bashford Dean, of Columbia College, N. Y., lectured on "Oyster Culture in Europe," illustrated with lantern slides.

September 21, 1896.—STATED MEETING.

VICE-PRESIDENT RITTER in the chair.

E. W. Maslin and W. J. V. Osterhout were proposed for membership.

Andrew C. Lawson, Professor of Geology and Mineralogy at the University of California, delivered an illustrated lecture on "The Evolution of Land Forms."

October 5, 1896.—STATED MEETING.

Bryan J. Clinch was proposed for membership.

Donations to the Museum were reported from J. Z. Davis and the *Call* Publishing Co.

Additions to the Department of Herpetology were reported from Gustav Eisen.

Additions to the Library:

From correspondents	168
By purchase	35
By donation	15

The paper of the evening was presented by Marsden Manson, of the Bureau of Highways, Sacramento, California; subject: "The Columbia Lava Plain and Its Local Climatic Influence," illustrated with lantern slides.

October 19, 1896.—STATED MEETING.

The PRESIDENT in the chair.

John L. Howard was elected a resident member.

Dr. Cameron Knight was proposed for membership.

Donations to the Museum were reported from Alexander Craw and George A. Treadwell.

President Jordan presented the Academy with five specimens of the Fur Seal, consisting of adult male and female, two black pups, and a young male; also a brown Sea Lion pup—from Pribylov Islands.

Leverett M. Loomis, Curator of the Department of Ornithology, lectured

N. A. Freeman for "Buckskin Jack," chief of a tribe of Indians, and Mrs. R. F. Dodd.

Donations to the Herbarium were reported from T. D. A. Cockerell, of the College of Agriculture, New Mexico; J. Burtt Davy, and C. F. Sonne; also 754 plants presented by the Curator, and 180 Arizona specimens from J. W. Tuomey, of the College of Agriculture, Arizona, in exchange.

Additions to the Library:

From correspondents	175
By purchase	36
By donation	13

Dr. H. W. Harkness offered the following resolutions on the death of J. Z. Davis:

WHEREAS, By the death of Mr. J. Z. Davis, Director of our Museum, this Academy has lost not only a disinterested friend and associate, but a generous patron, who was ever ready with purse and counsel to assist the workers in the various departments, and to add to and embellish our Museum;

Therefore be it resolved, That we, as members of this Association, do deeply deplore the death of one so generous, and so active in advancing the interests of our Society.

Be it further resolved, That we, as members of this Academy, do attend his funeral, and that these resolutions be spread upon the minutes of our proceedings.

Professor George Davidson presented the paper of the evening: "The Submerged Valleys on the Pacific Coast," illustrated with lantern slides.

November 16, 1896.—STATED MEETING.

VICE-PRESIDENT RITTER in the chair.

The name of Bryan J. Clinch was balloted for, but a quorum not being present there was no election.

Professor G. Wharton James delivered an illustrated lecture on "The Mokis and the Snake Dance at Oraibi."

December 7, 1896.—STATED MEETING.

VICE-PRESIDENT RITTER in the chair.

Donations to the Museum were reported from George A. Treadwell, Leverett M. Loomis, F. H. Wales, C. E. Hayes, and J. G. Cooper.

An addition to the Department of Ornithology of 139 water birds from

Monterey Bay and the adjacent ocean was made during the recent trip of the Curator, Mr. L. M. Loomis, to that vicinity.

Additions to the Library:

From correspondents.....166
By purchase..... 69
By donation..... 9

The following papers were read by title:

California Water Birds. No. II.—Vicinity of Monterey in Midwinter. By Leverett M. Loomis.

New Mallophaga, I, with Special Reference to a Collection made from Maritime Birds of the Bay of Monterey, California. By Vernon L. Kellogg.

North American Apterygogenea. By Harald Schätt.

Notes on Palæozoic Crustacea. No. 5.—Carboniferous Trilobites from Missouri. By A. W. Vogdes.

Description of a New Schizopod from Lake Merced. By Samuel J. Holmes.

Notes on Fishes Little Known or New to Science. By David Starr Jordan.

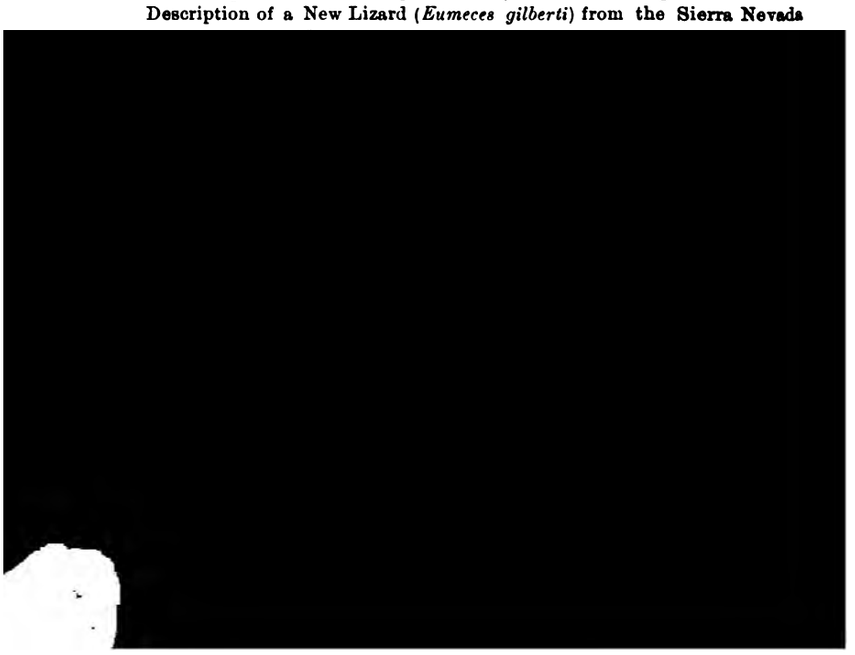
Notes on Fresh Water Fishes of the Pacific Slope of North America. By Cloudsley Rutter.

Report on a Collection of Plants from San Juan County, in Southeastern Utah. By Alice Eastwood.

On Some New Crustaceous (and Eocene?) Mollusca of California. By J. G. Cooper.

A List of Some Reptiles from Southeastern Arizona, with a Description of a New Species of Cnemidophorus. By J. Van Denburgh.

Description of a New Lizard (*Eumeces gilberti*) from the Sierra Nevada



December 21, 1896.—STATED MEETING.

VICE-PRESIDENT BEHR in the chair.

On motion of Mr. Chapman, seconded by Mr. Keeler, the following resolution was adopted:

"In view of the fact that certain birds in California are threatened with extinction, owing to persistent persecution upon their nesting grounds, it is urgent that immediate action be taken to secure protection for them, and I would therefore move that a committee of three be appointed to report at the next meeting of the Academy the state of the existing California law bearing upon birds, and the amendments necessary to afford protection to song birds, and to birds during the nesting season."

The chairman named the following members as a committee to act under the resolution:

William S. Chapman, William M. Pierson and Charles A. Keeler.

The nominating committee made their report, naming the following ticket:

For *President*, David Starr Jordan.
First Vice-President, William E. Ritter.
Second Vice-President, H. H. Behr.
Corresponding Secretary, J. O'B. Gunn.
Recording Secretary, G. P. Rixford.
Treasurer, L. H. Foote.
Librarian, George C. Edwards.
Director of Museum, Charles A. Keeler.
Trustees—William M. Pierson, Irving M. Scott, Charles F. Crocker, Lewis Gerstle, E. J. Molera, George C. Perkins and G. W. Stewart.

The paper of the evening was presented by Harold W. Fairbanks, Ph. D., "An Outline of the Geological History of California," illustrated with lantern slides.

January 4, 1897—STATED MEETING.

The PRESIDENT in the chair.

The committee appointed on Bird Protection reported as follows:

To the President and Members of the Academy of Sciences:—Your committee, heretofore appointed for the purpose of taking into consideration and reporting to this body the form of such legislation as is needed for the protection of wild birds in this State, beg leave to report as follows:

They have examined the laws of the various States of the Union and find that in New York and Massachusetts particularly the legislation has been substantially what the committee deems desirable to have upon the statute books of this State. They recommend therefore that the Legisla-

ture be asked by this Academy to pass an amendment to the present 'Game Laws' of the State. Provision substantially in the following form:

SECTION 1. "Wild birds shall not be killed or caught at any time, or possessed after the same are dead. This provision does not affect any birds the killing of which is prohibited between certain dates, under acts of the Legislature now in force, nor does it protect the 'English sparrow,' and it does not apply to any person holding a certificate under the provisions of Section 3 of this Act. Whoever shall violate or attempt to violate the provisions of this section shall be deemed guilty of misdemeanor, and in addition thereto, shall be liable to a penalty of $25 for each bird killed, trapped or destroyed contrary to the provisions of this section."

SEC. 2. "The eggs of wild birds shall not be offered for sale, or their nests robbed or willfully or needlessly destroyed, unless when necessary to protect buildings or prevent their defacement. This section does not apply to the 'English sparrow.' Whoever shall violate or attempt to violate the provisions of this section shall be deemed guilty of a misdemeanor, and in addition thereto, shall be liable to a penalty of $25 for each nest robbed or destroyed, contrary to the provisions of this section."

SEC. 3. "Certificates may be granted by any university, college or incorporated society of natural history in this State through such persons or officers as such society may designate to any properly accredited person, permitting the holder thereof to collect birds, their nests or eggs, for strictly scientific purposes only. In order to obtain such certificate, the applicant for the same must present to the person or persons having the power to grant such certificates, written testimonials from two well-known scientific men, certifying to the good character and fitness of said applicant to be entrusted with such privilege. Such certificates to be in force for one year and no longer."

As the result of the annual election, the following were declared officers for the ensuing year:

DAVID STARR JORDAN, *President.*
WILLIAM E. RITTER, *First Vice-President.*
H. H. BEHR, *Second Vice-President.*
J. O'B. GUNN, *Corresponding Secretary.*
G. P. RIXFORD, *Recording Secretary.*
L. H. FOOTE, *Treasurer.*
GEORGE C. EDWARDS, *Librarian.*
CHARLES A. KEELER, *Director of Museum.*

Trustees:

WILLIAM M. PIERSON,	IRVING M. SCOTT,	CHARLES F. CROCKER,
LEWIS GERSTLE,	E. J. MOLERA,	GEORGE C. PERKINS,
	G. W. STEWART.	

The annual report of the President was read, and on motion a committee of three was appointed to take into consideration that part of the report bearing upon the burden of taxation imposed upon the Academy, with the view of procuring the necessary legislation to exempt it and other similar institutions from such burden.

Reports of Curators and Officers and Board of Trustees were read and ordered placed on file.

A Resolution regarding the funds for the payments of taxes was read and accepted.

REPORT OF THE LIBRARIAN FOR 1896.

The additions to the library for the year 1896 have been as follows:

From correspondents	1897
By purchase	1010
By donation	99
By exchange	1
Total	3007

Valuable donations of books and pamplets have been received from the following: Nathan Banks, James M. Macoun, Alpheus Spring Packard, F. W. Putnam, Henri di Saussure, Frank W. Very, A. W. Vogdes, Elstanislao S. Zeballos, C. F. Baker, Alberto Sanchez, E. D. Cope, S. Garman, Geo. C. Perkins, Henry B. Ward, F. W. Clark, Robert L. Jack, A. Bastian, H. C. Russell, Spanish Consulate (San Francisco), H. W. Turner, F. F. Allen, William Trelease, F. Franceschi, Isabel A. Mulford, Charles Henry Thompson, Clarence B. Moore, C. C. Willoughby, G. A. Dorsey, William Butenmüller, J. Douglas Ogilby, Edm. de Selys Longchamps, Baron F. von Muller, Charles A. White, Axel Rydberg, Mark Baldwin, W. McM.

Woodworth, R. A. Philippi, Botanical Society of America, Le Dr. Saint Lager, and Outram Bangs.

The balance of the Pierce fund, amounting to $1200, has been expended on publications ordered last year. With this fund the set of the London Quarterly Journal of Microscopical Science has been completed, and the following publications have been added to the library:

Giornale di Scienze Naturali en Economische. Palermo. 1866–1890.
Journal de Zoologie. Paris. 1872-1877.
Museum d'Histoire Naturelle. Paris. Annales, vols. i-xx. Archives, vols. i-x; Nouvelle Archives, vols. i-x; series 2, vols. i-x; series 3, vols. i-vii; Memoires, vols. i-xx; Nouvelles Memoires, vols. i-iv.
Société Geologique de France. Paris. Memoires, tomes i-v; series 2, tomes i-x; series 3, tomes i-v. Memoires Paléontologie, tomes i-v. Bulletin, tomes i-xiv; series 2, tomes i-xxix; series 3, tomes i-xxiii. Table des volumes 1830-1863.
Bornet, Ed & G. Thuret, Notes Algologiques. Paris. 1880.
Gray, George Robert. Hand List of Birds of the British Museum. London. 1869-1871.
Presl, Carolus Bor. Reliquiæ Hænkeanæ. Pragæ. 1825.
Wiegmann, Dr. A. F. A. Herpetologia Mexicana. Berolini. 1834.

ERRATA.

Page 38, line 15, for *Bothoriometopus* read *Bothriometopus*.
Page 45, sixth line from bottom, for *pelasgia* read *pelagica*.
Page 49, tenth line from bottom, for *toxoceras* read *toxoceros*.
Page 56, second column, thirteenth line from bottom, for *toxoceras* read *toxoceros*.

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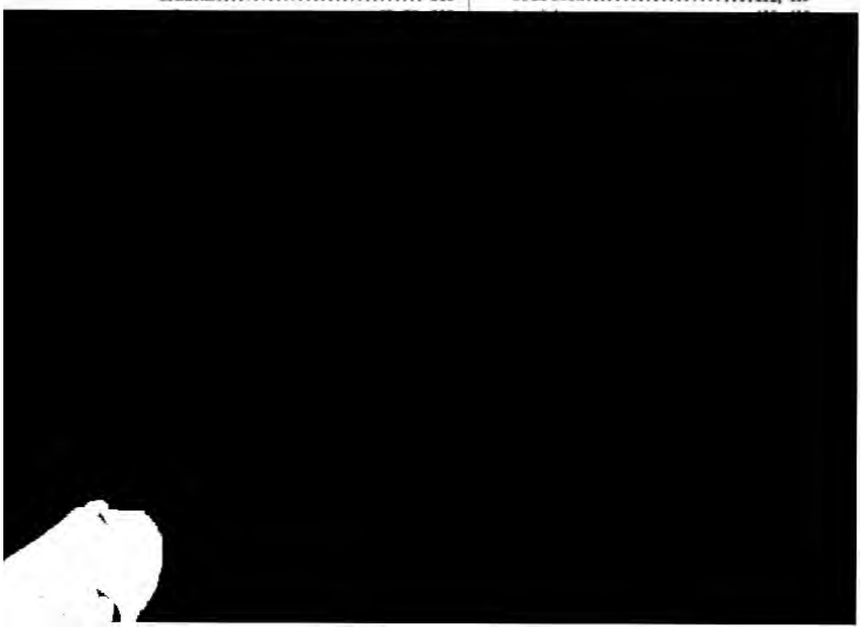

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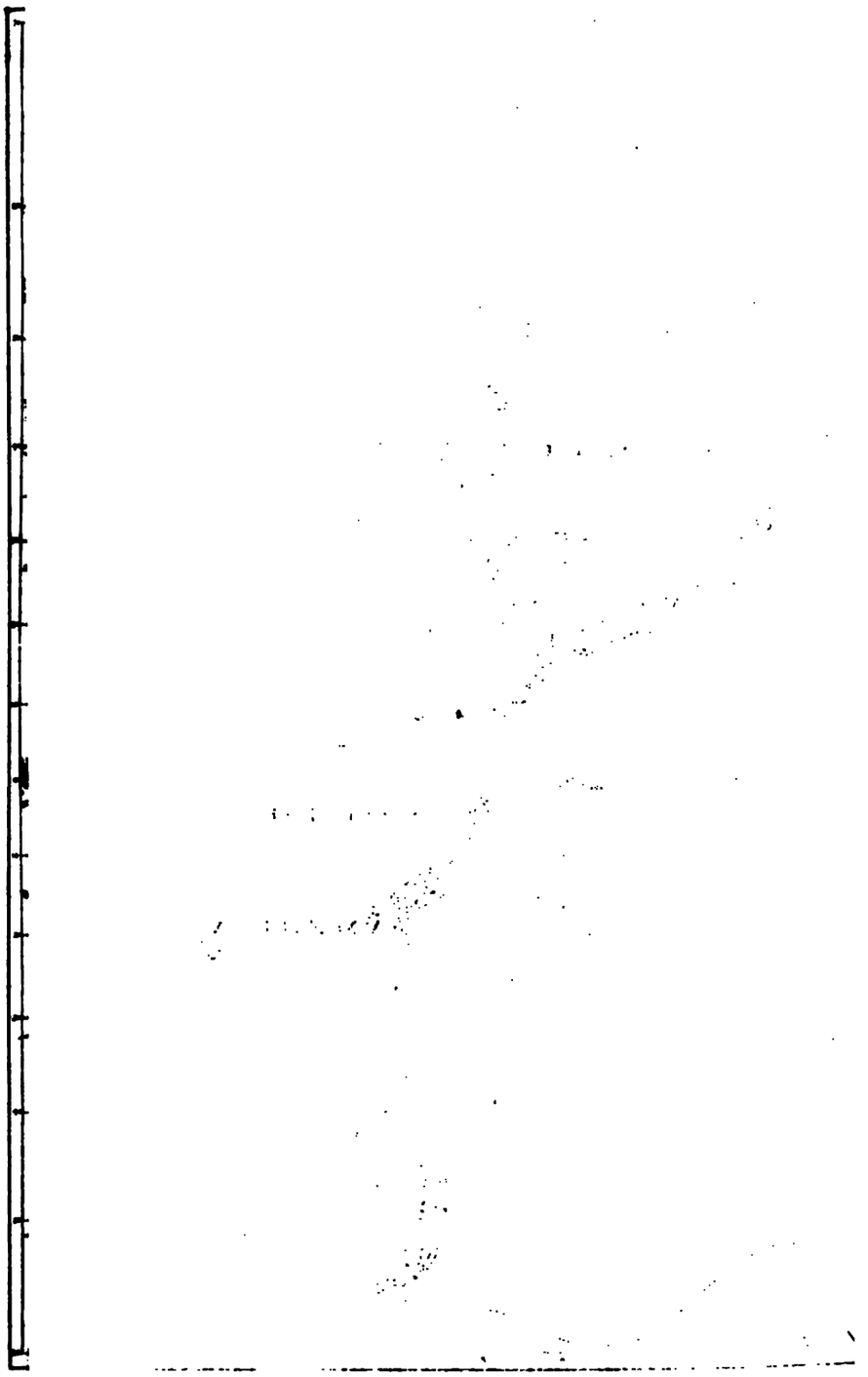

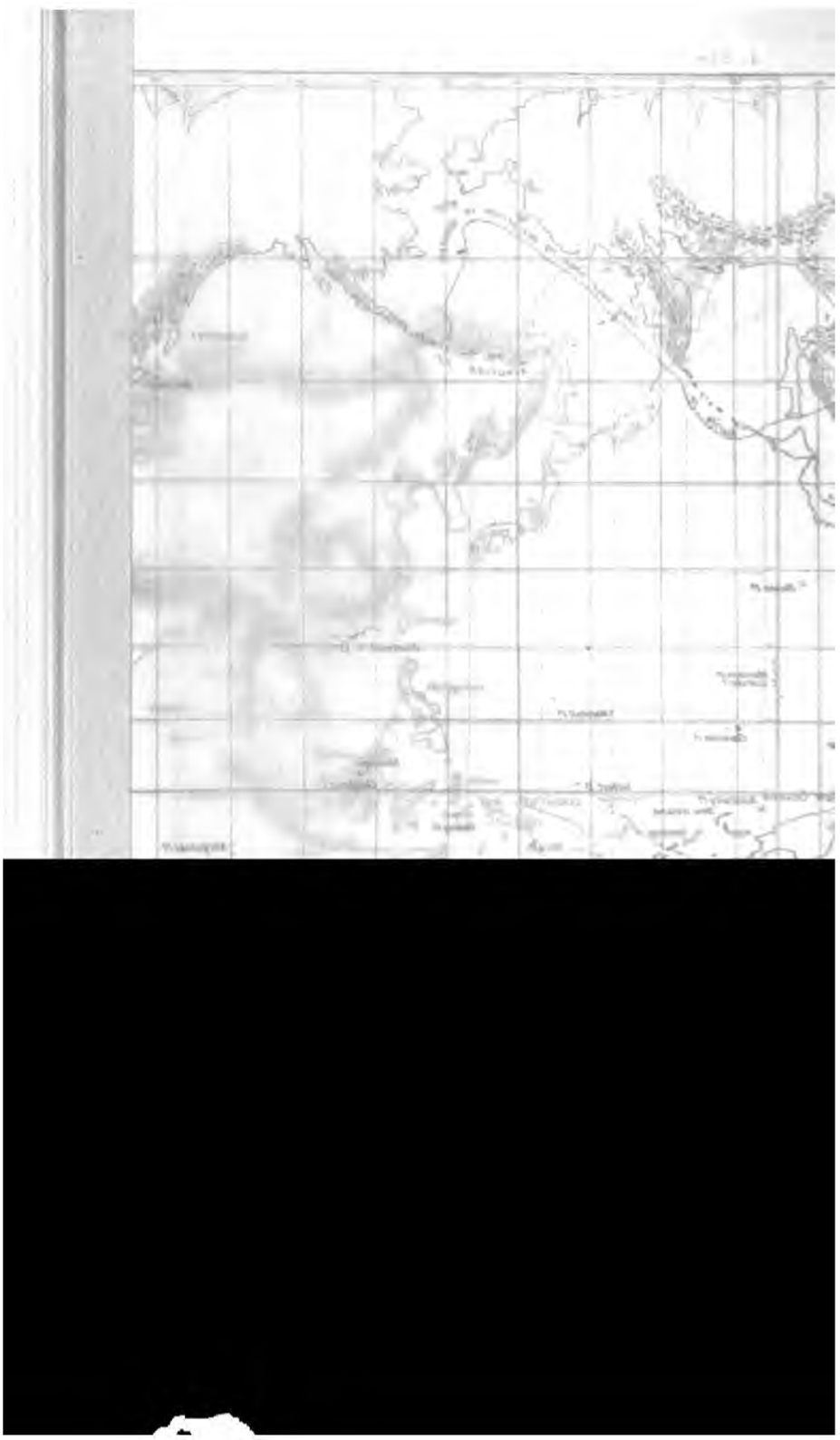

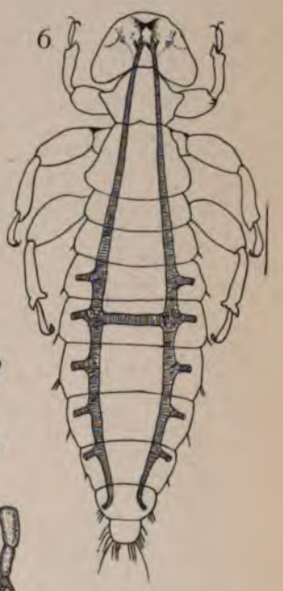

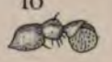

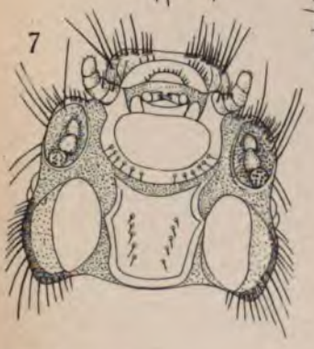

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EDNA BOYCE, DEL. LITH. BRITTON & REY. S.F.

EDWD. POST, DEL.

LITH. BRITTON & REY, S.F.

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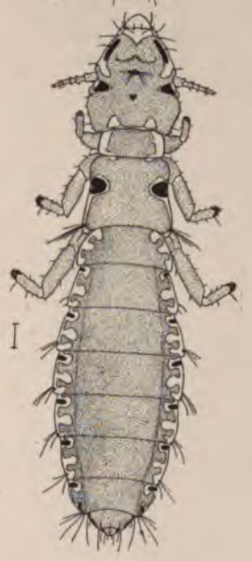

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EDNA HOYT, DEL.

LITH. BRITTON & REY SC.

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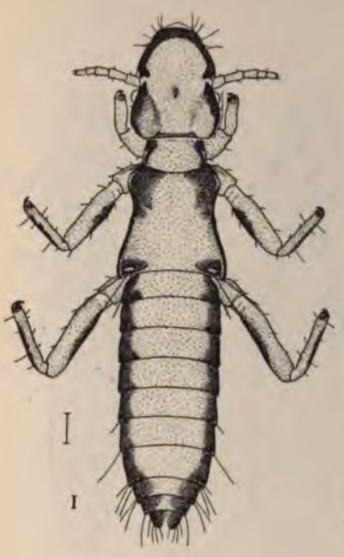

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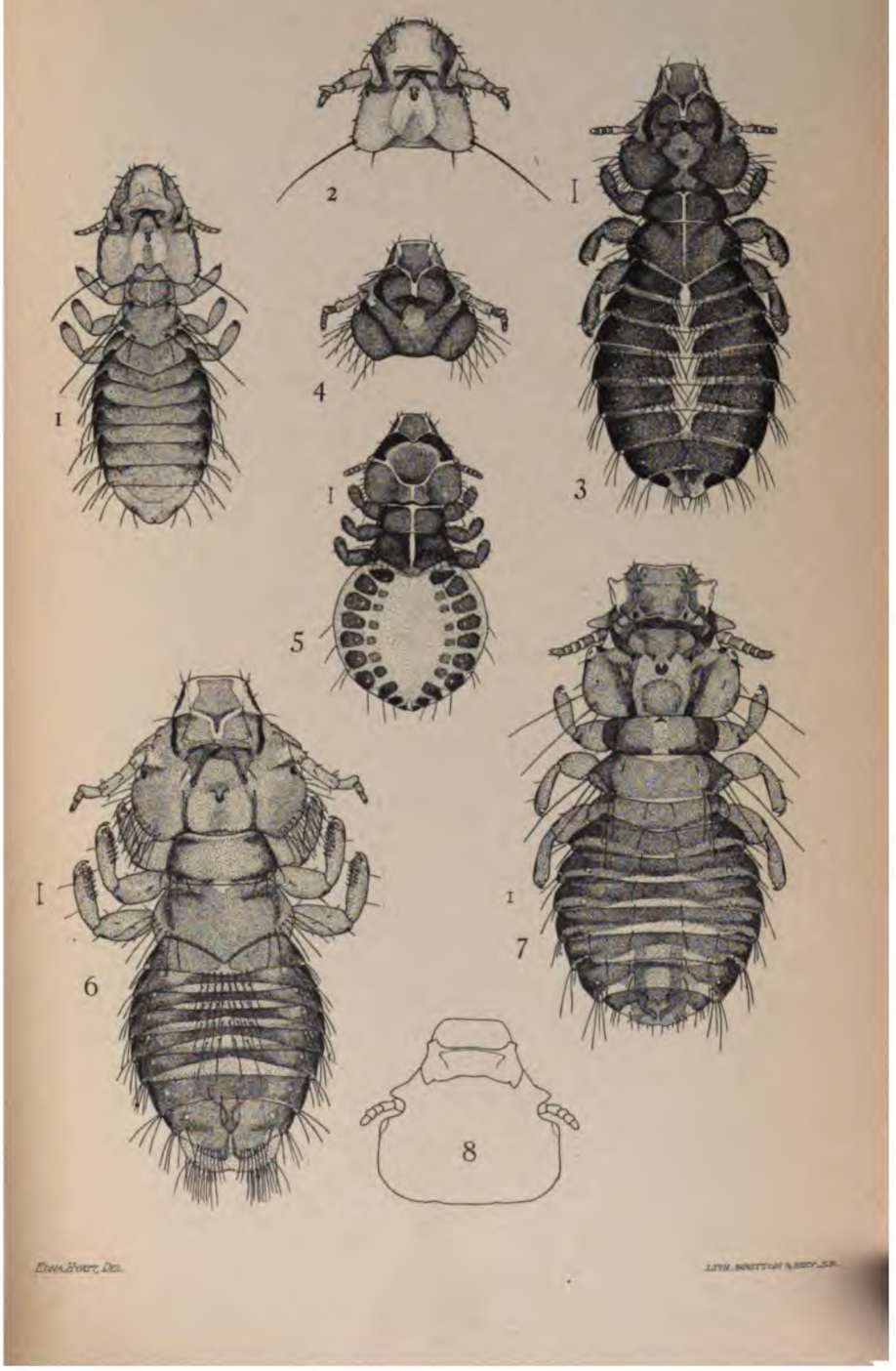
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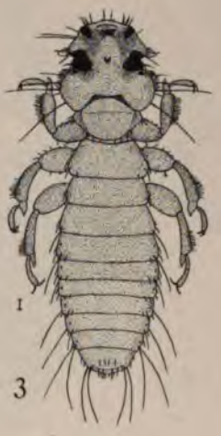
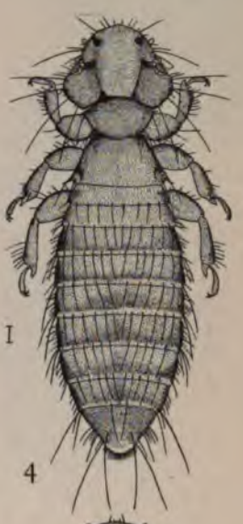
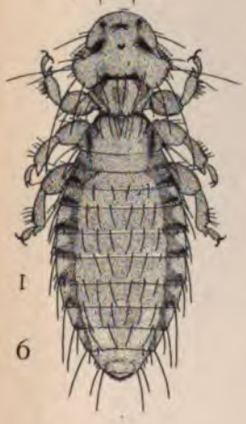
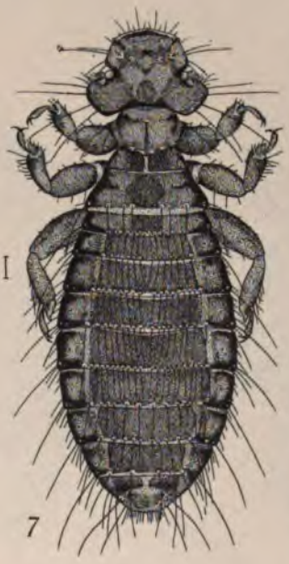


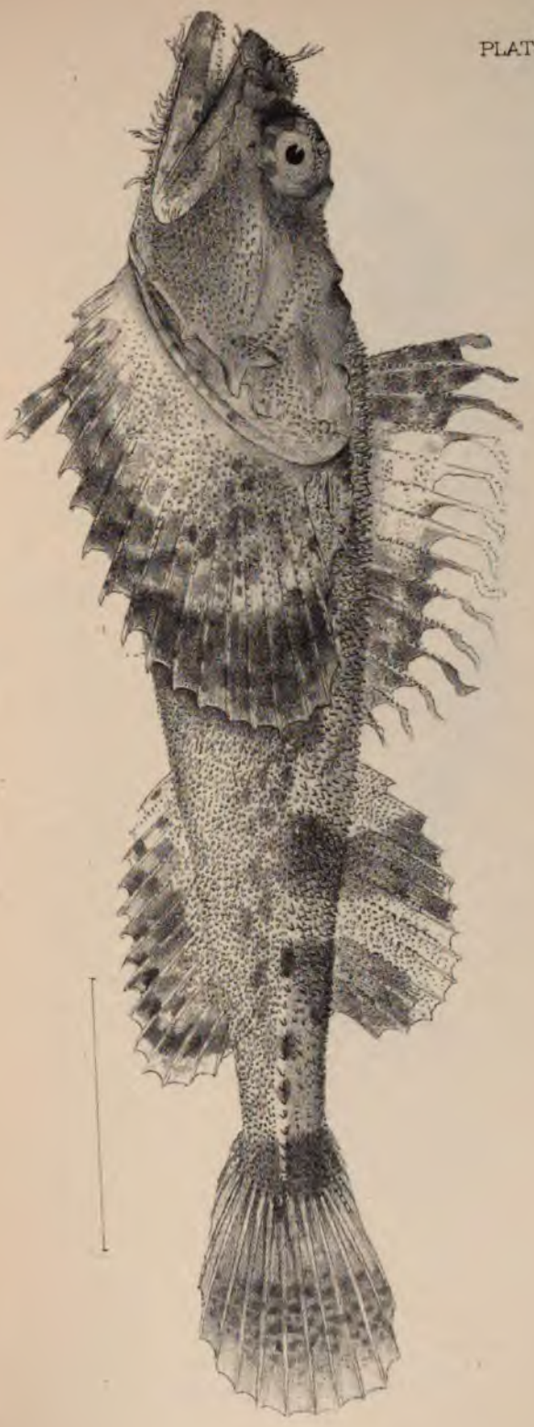






EDWD. BURTT, DEL. LITH. BRITTON & REY, S.F.

PLATE XXX.



ULCA MARMORATA

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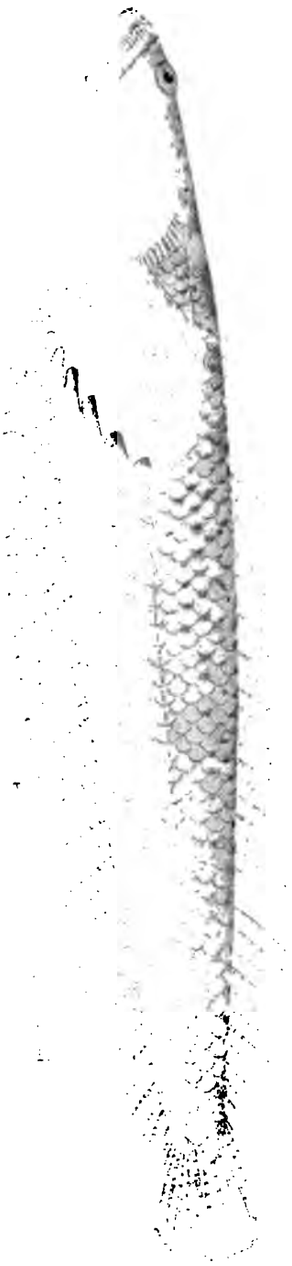
PLATE XXXIII.



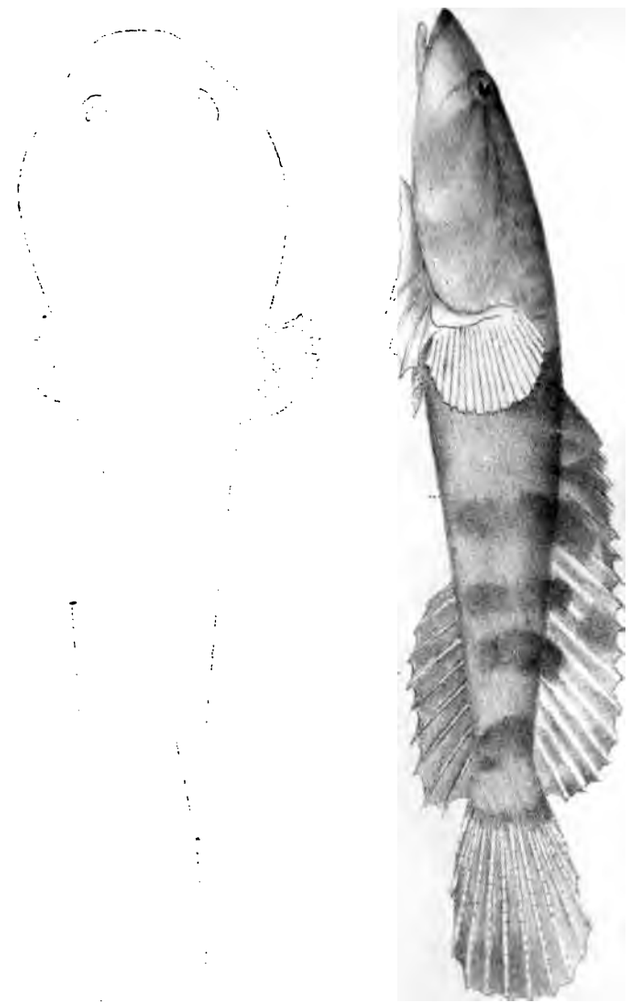
DACTYLAGNUS MUNDUS

LYCODAPUS FIERASFER

LITH. BRISTOW

AGNEW & BROWNE, LITH.

PLATE XXXIV.



BRYSSETÆRES PINNIGER

ANNA L. BROWN, DEL.

LITH. BRITT.ⁿ

PLATE XXXV.

ARBACIOSA HUMERALIS

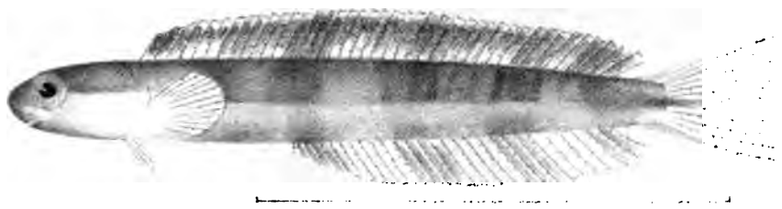
ANNA L. BROWN, DEL.

LITH. BRITTON & MIL

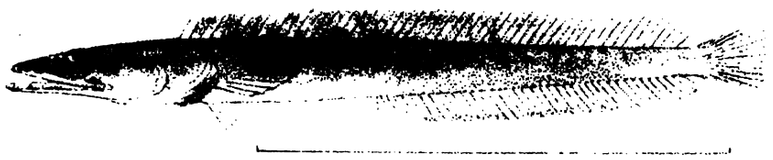
PLATE XXVI.

EMMYDRICHTHYS VULCANUS

PLATE XXXVII.



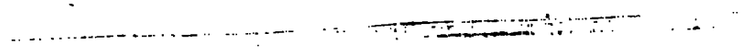
RUNULA AZALEA



LUCIOBLENNIUS ALEPIDOTUS

ARBACIOSA EOS

ANNA L. BROWN DEL. LITH. BRITTON & HAY. S.N.



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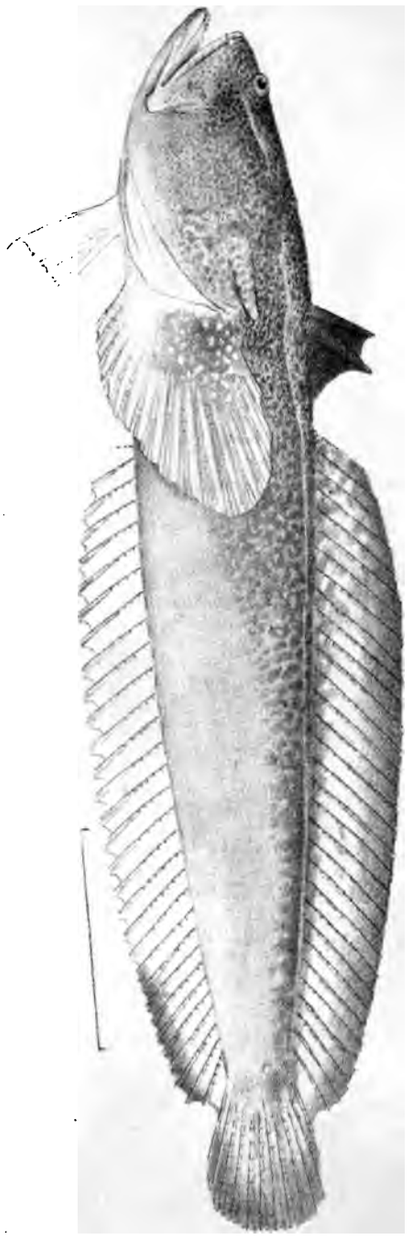
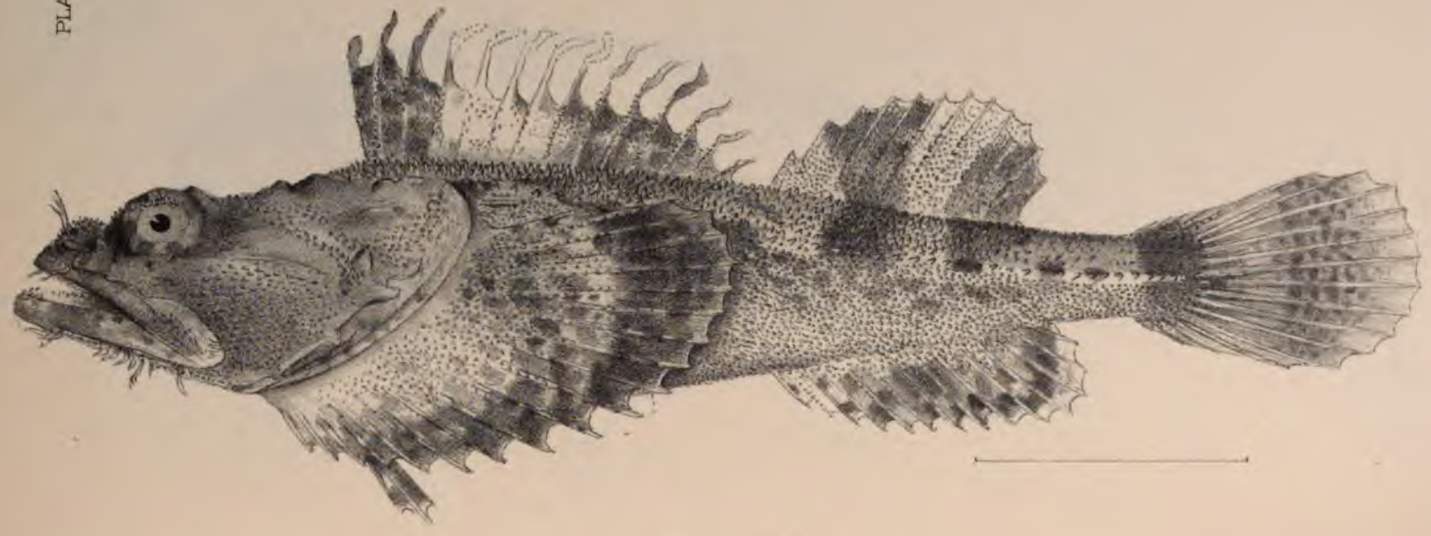


THALASSOPHRYNE DOWI

ANNA L. BROWN DEL.

LITH. BRITTEN.

PLATE XXX.

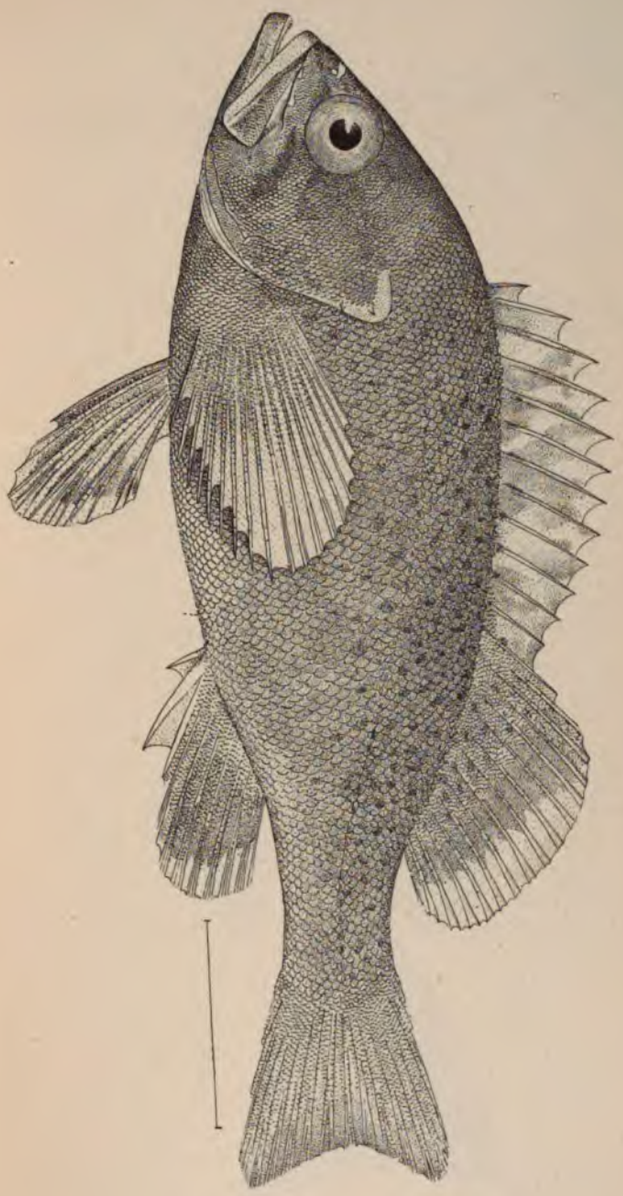


ULCA MARMORATA

ANNA L. BROOME DEL.

LITH. BRITTON & REY. SF

PLATE XL.

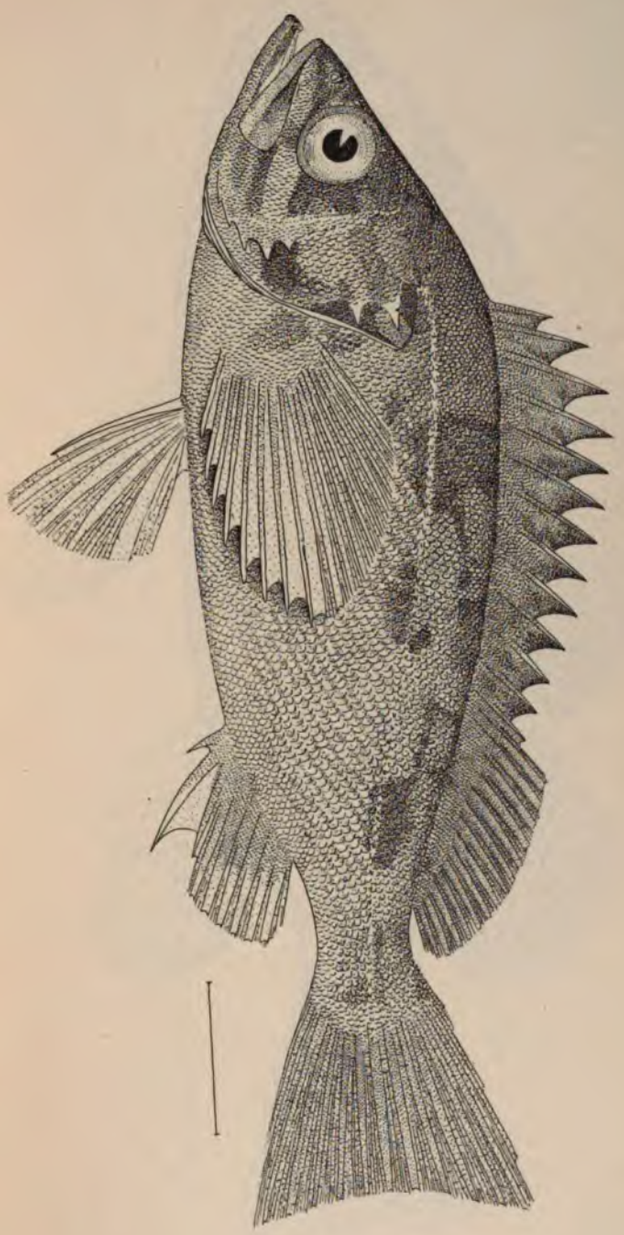


SEBASTODES CILIATUS

ANNA L. BEECHER DEL.

LITH. BRITTON & REY, S.F.

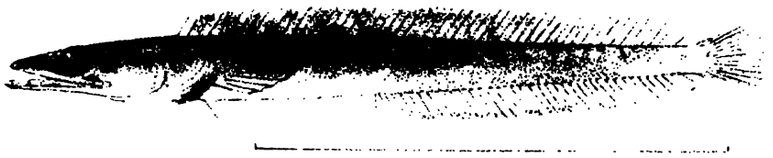
PLATE XLI.



SEBASTODES HOPKINSI

ANNA L. BROWN, DEL.

RUNULA AZALEA

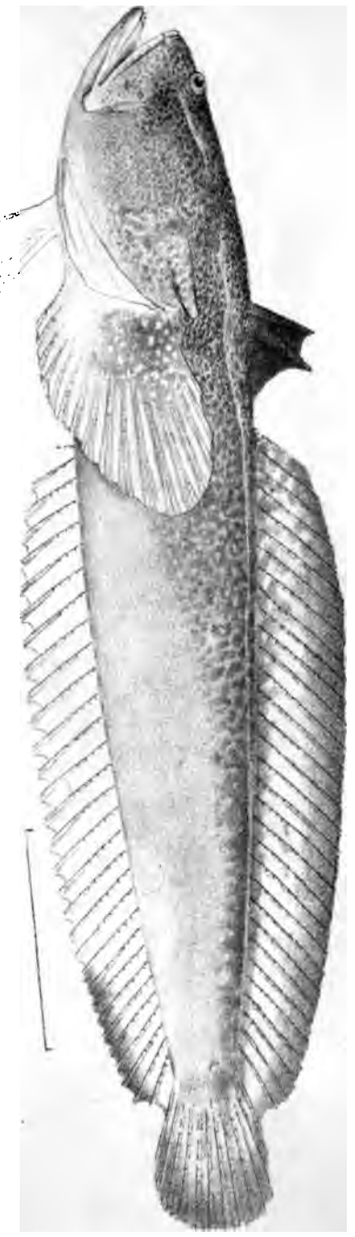


LUCIOBLENNIUS ALEPIDOTUS

ARBACIOSA EOS

ANNA L. BROWN DEL. LITH. BRITTON & REY. SC.

PLATE XXXVIII.



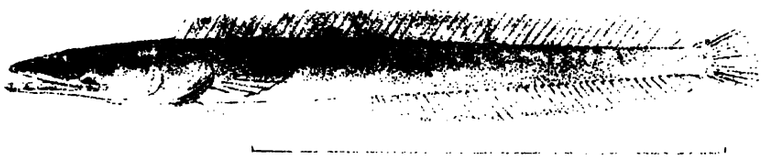
THALASSOPHRYNE DOWI

ANNA L. BROWN DEL.

LITH. BRITTON & RE

PLATE XXXVII.

RUNULA AZALEA



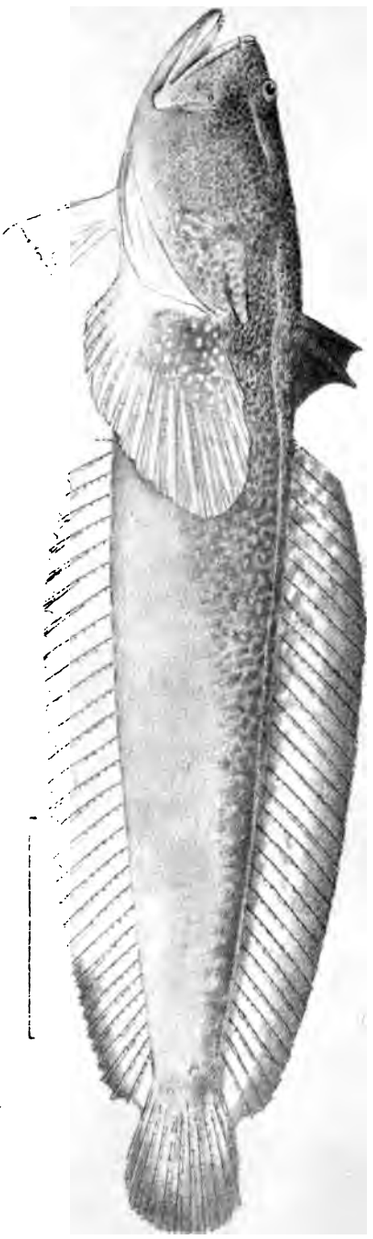
LUCIOBLENNIUS ALEPIDOTUS

ARBACIOSA EOS

ANNA L. BROWN, DEL.

LITH. BROTT & A. WEST 53D

PLATE XXXVIII.



THALASSOPHRYNE DOWI

ANNA L. BROWN, LITH.

LITH. BRITTON & REY. SC.

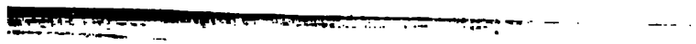
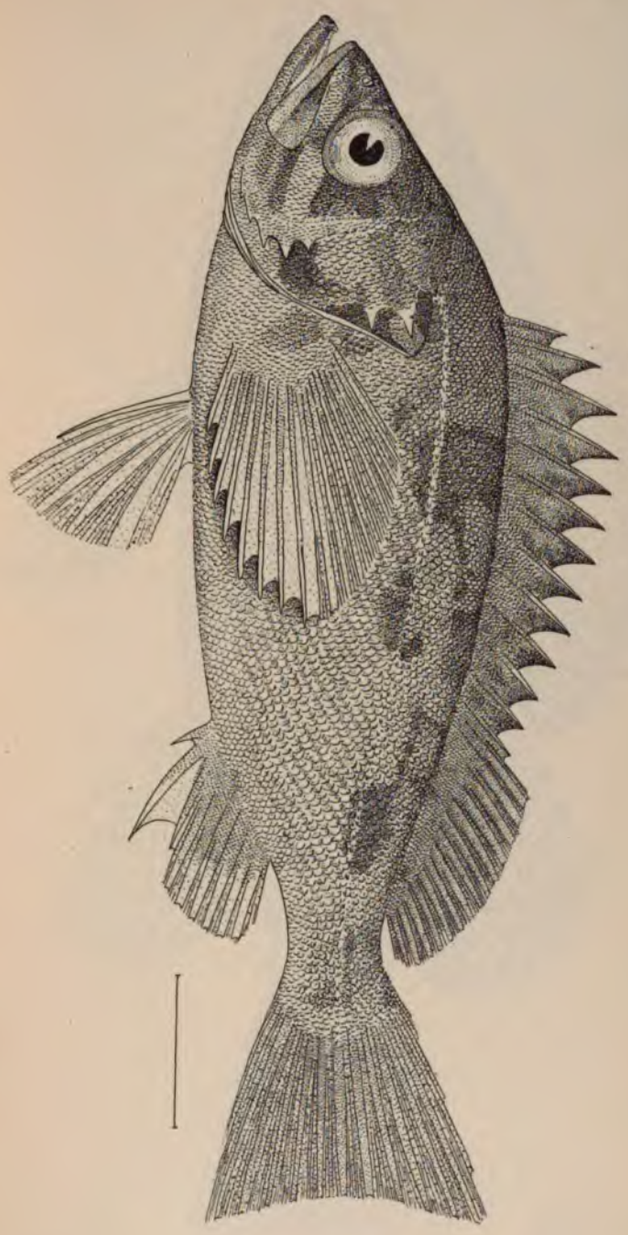


PLATE XLI.

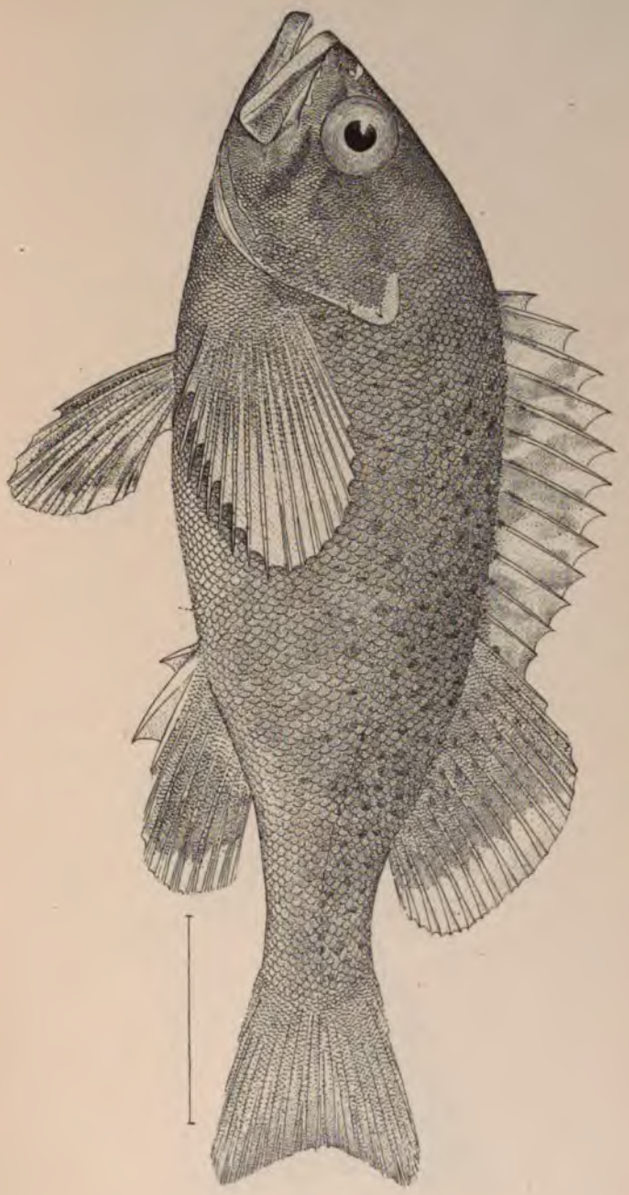


SEBASTODES HOPKINSI

NOEL L. BROWN, DEL.

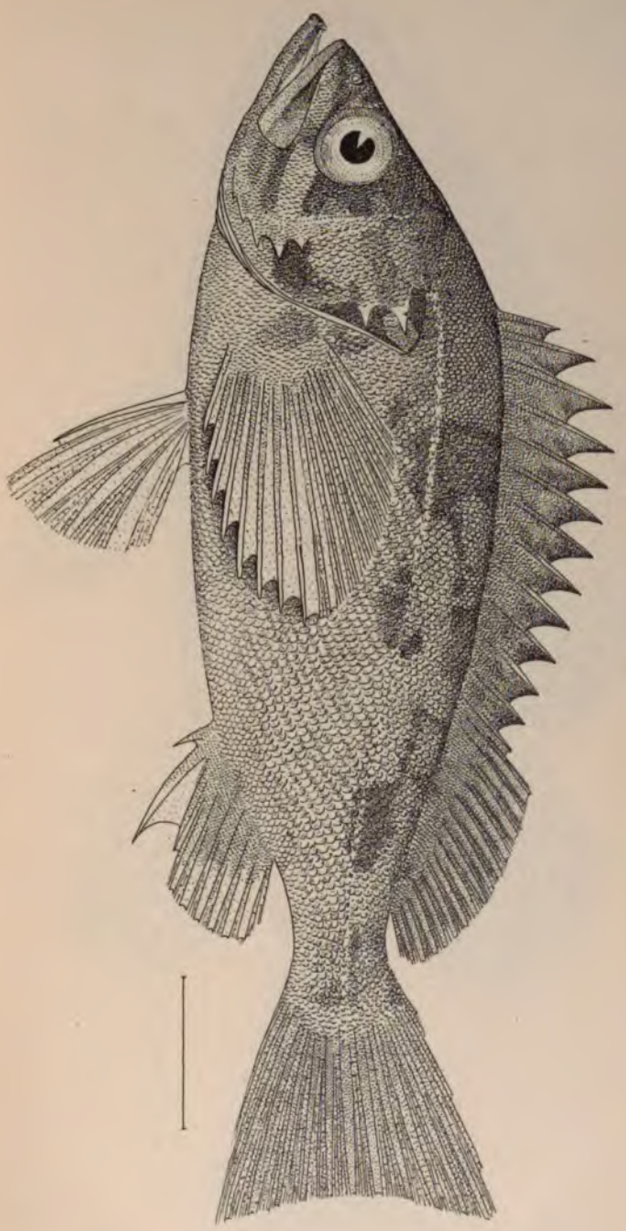
AUTOTYPE BRISTOL & WEST, LTD

PLATE XL.



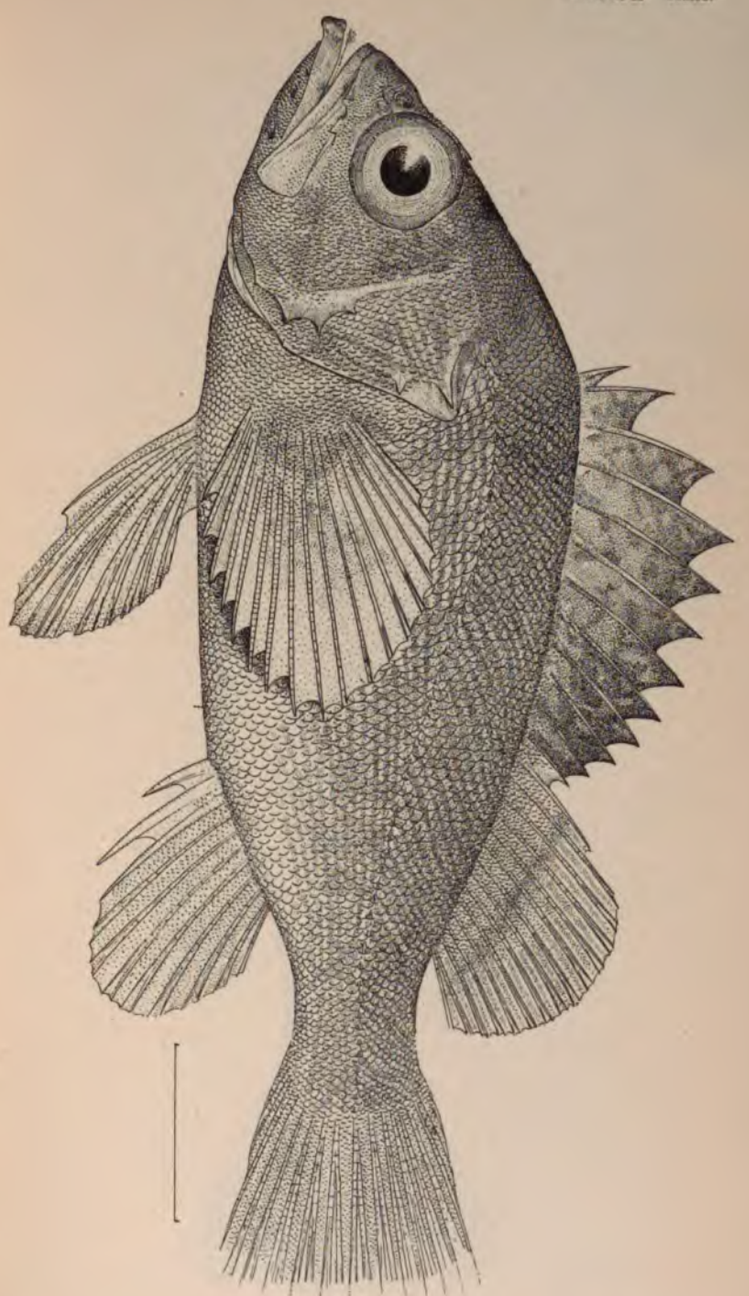
SEBASTODES CILIATUS

PLATE XLI.



SEBASTODES HOPKINSI

PLATE XLII.



SEBASTODES EIGENMANNI

Anna L. Brandt, Del.

Lith. Britton & Rey, S.F.

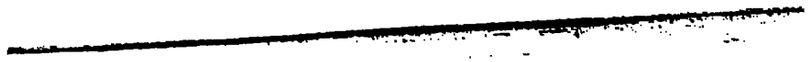
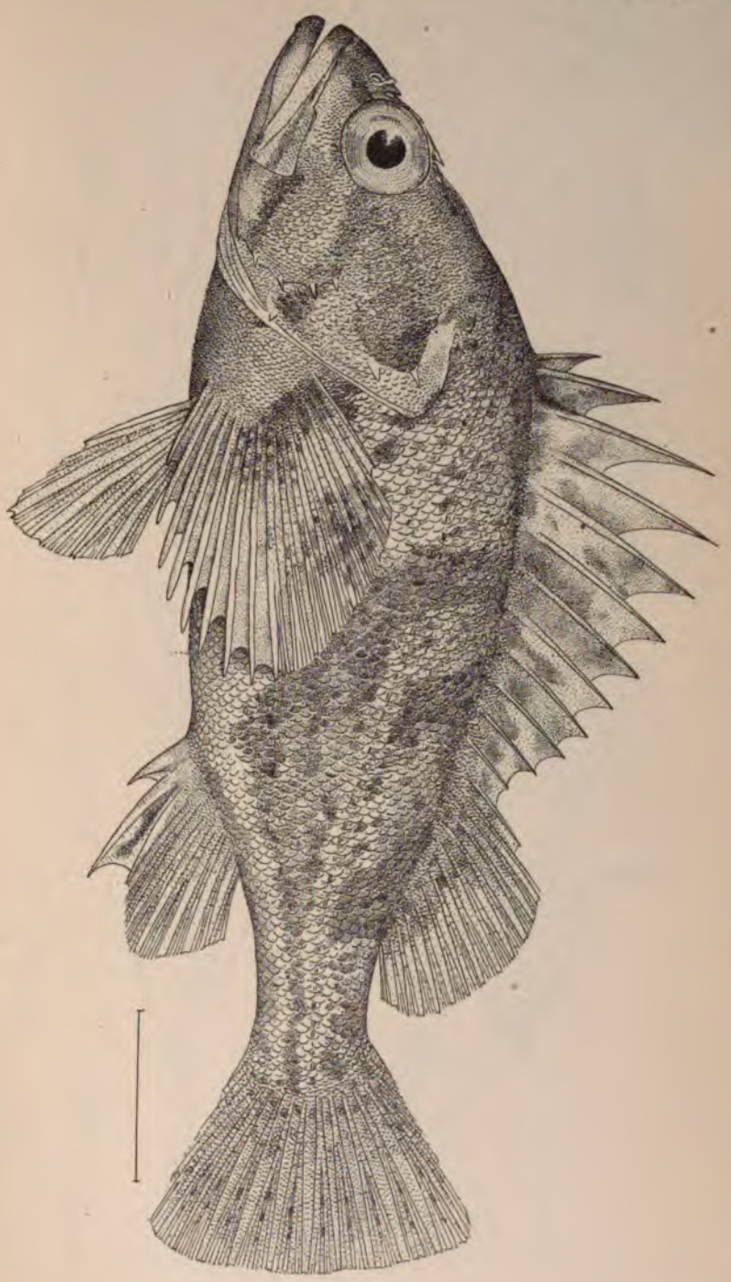
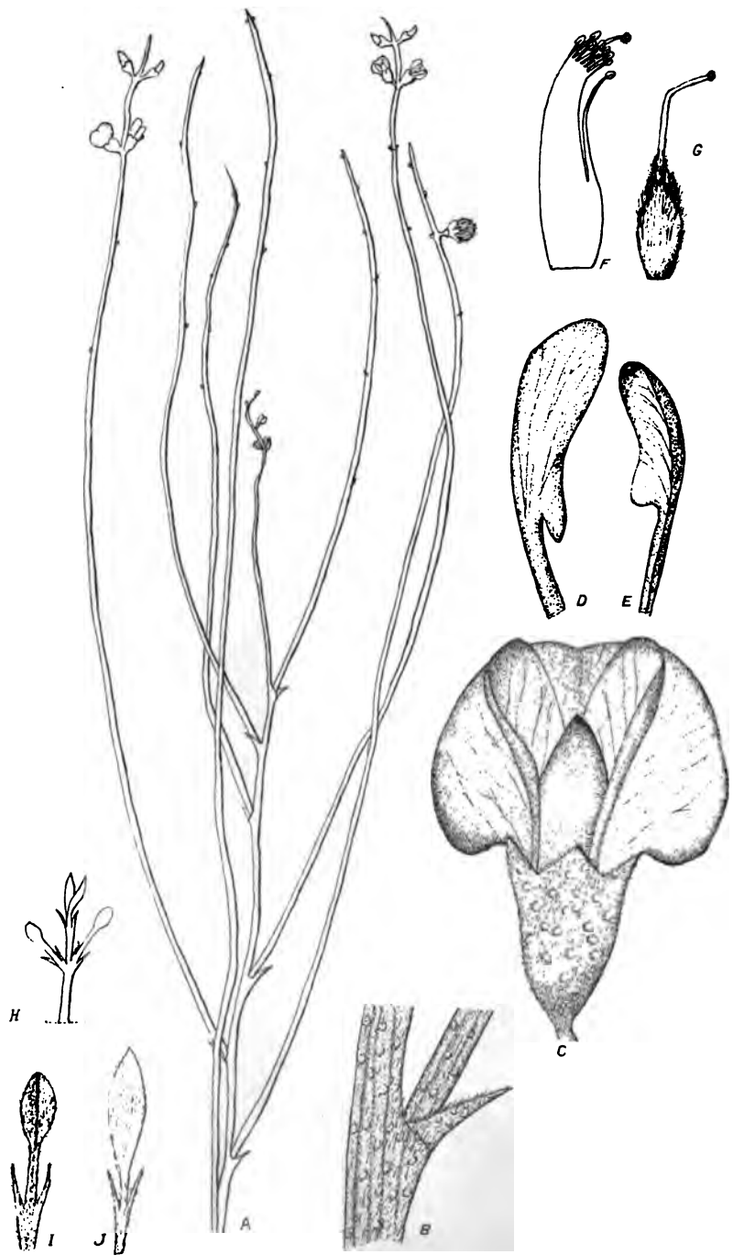


PLATE XLIII.



SEBASTODES GILBERTI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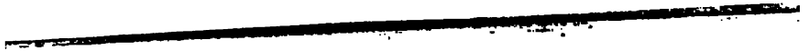

Plate XLV.

Dichoria paniculata Eastwood.

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ANDREA L. BROWN, DEL.

LITH. BRITTON & REY, S.F.

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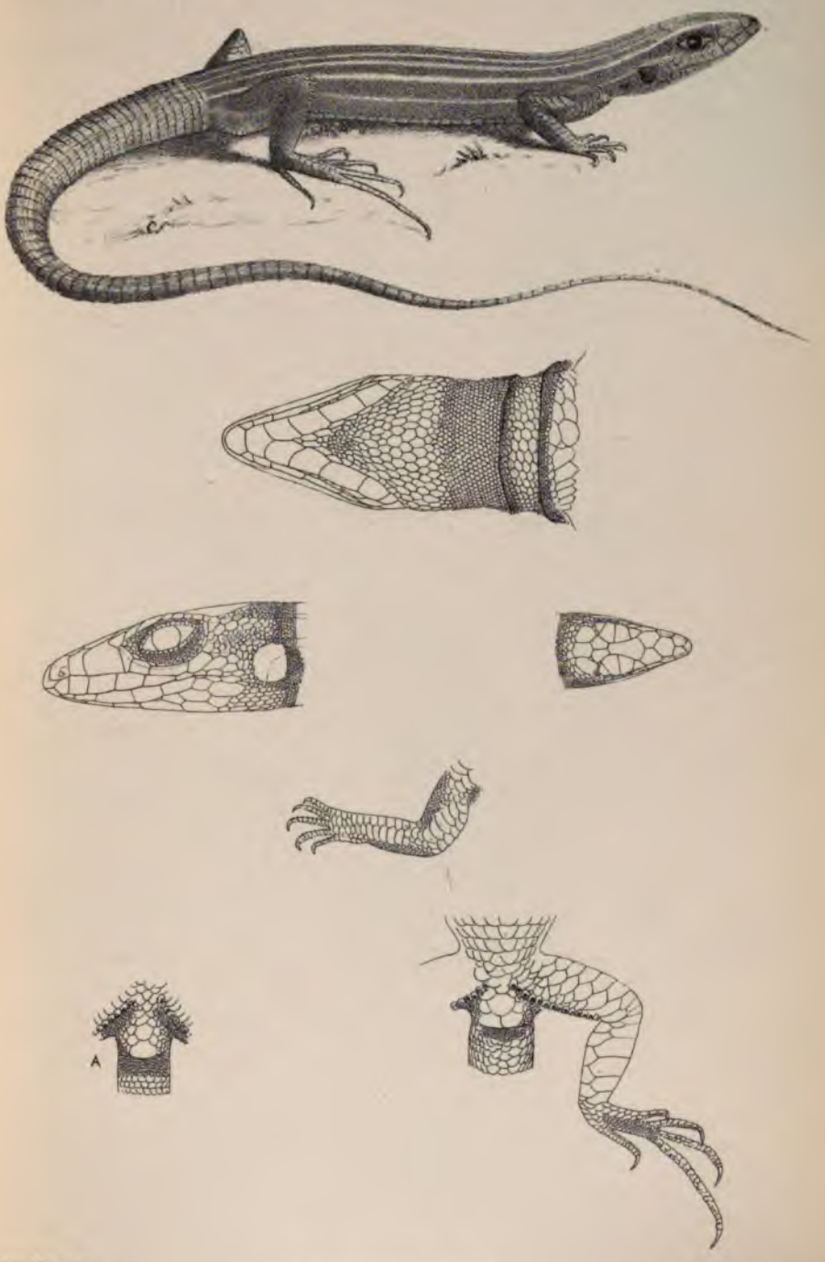
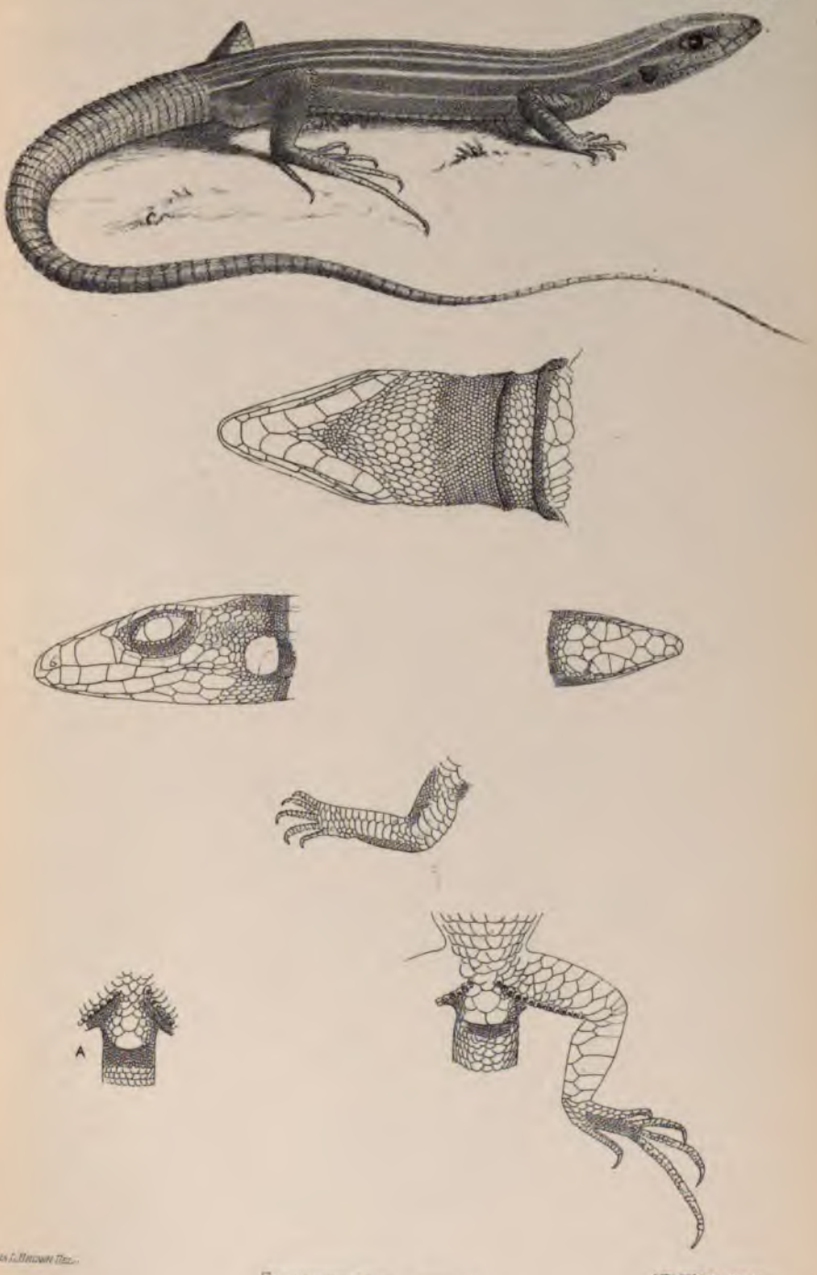
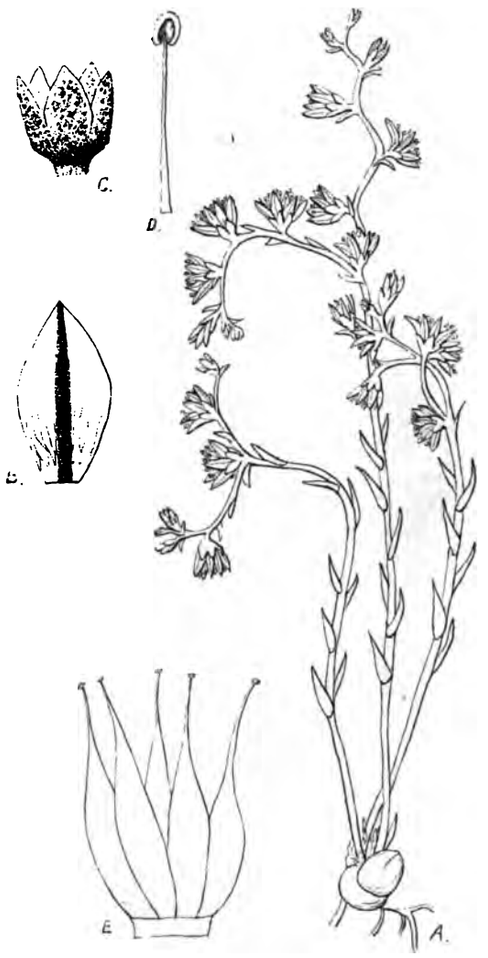
Anita L. Brown Del. Lith. of Britton & Rey, S.F.



CNEMIDOPHORUS ARIZONÆ.
A CNEMIDOPHORUS LABIALIS.

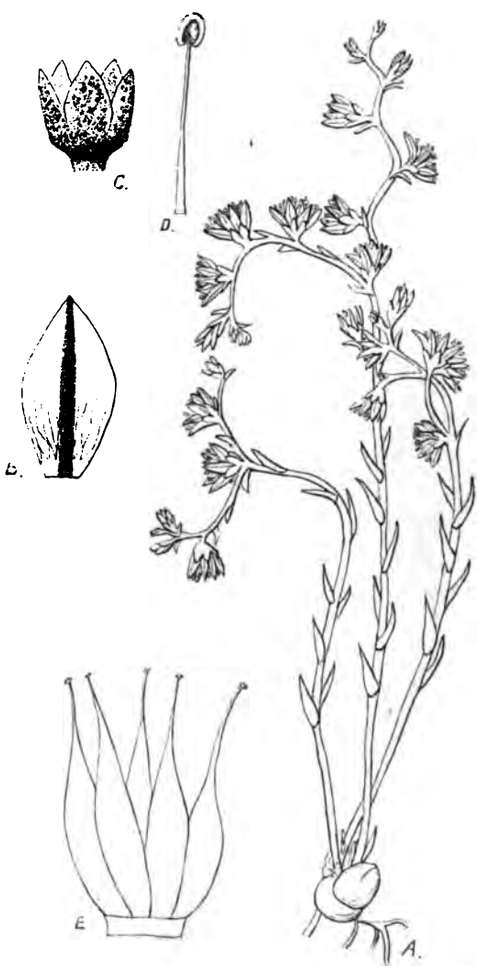


CNEMIDOPHORUS ARIZONÆ.
A CNEMIDOPHORUS LABIALIS.



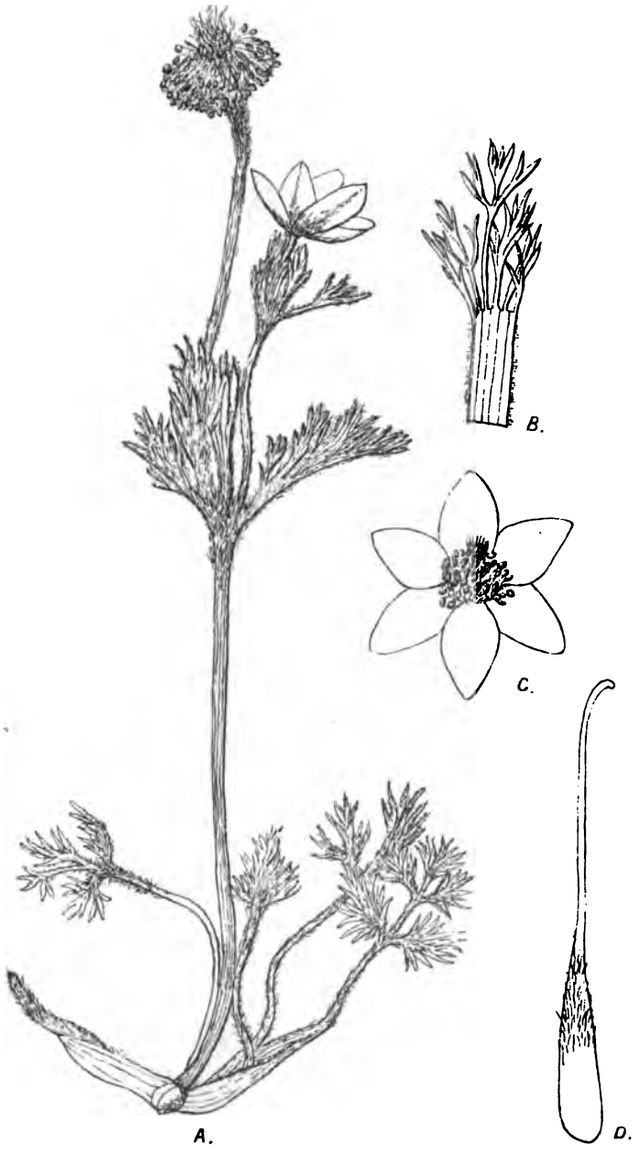
STYRAX BLOCHMANIÆ. EASTWOOD.

LITH. BRITTON & REY S.



SEDUM ELGLHMANN. EASTWOOD.

LITH. BRITTON & REY S. F.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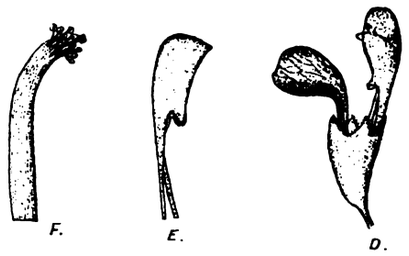
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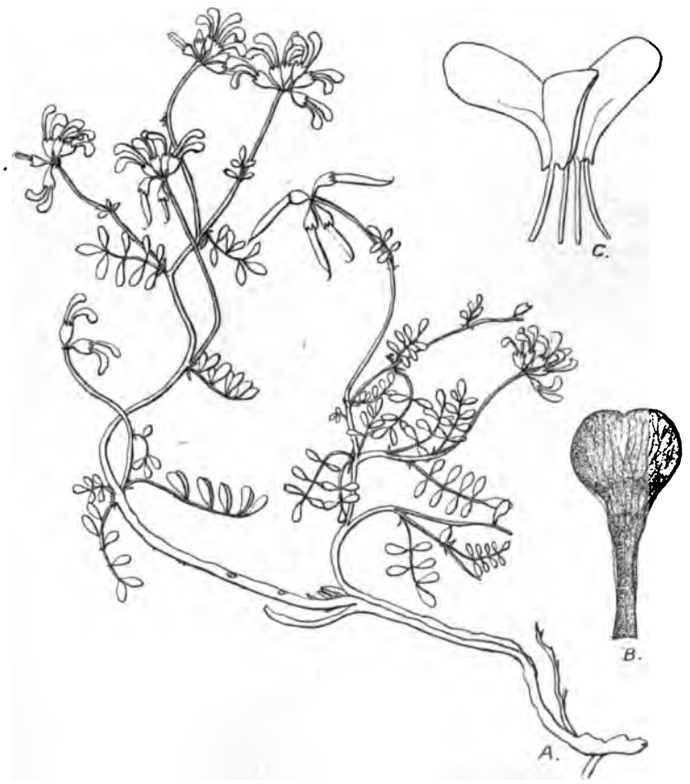
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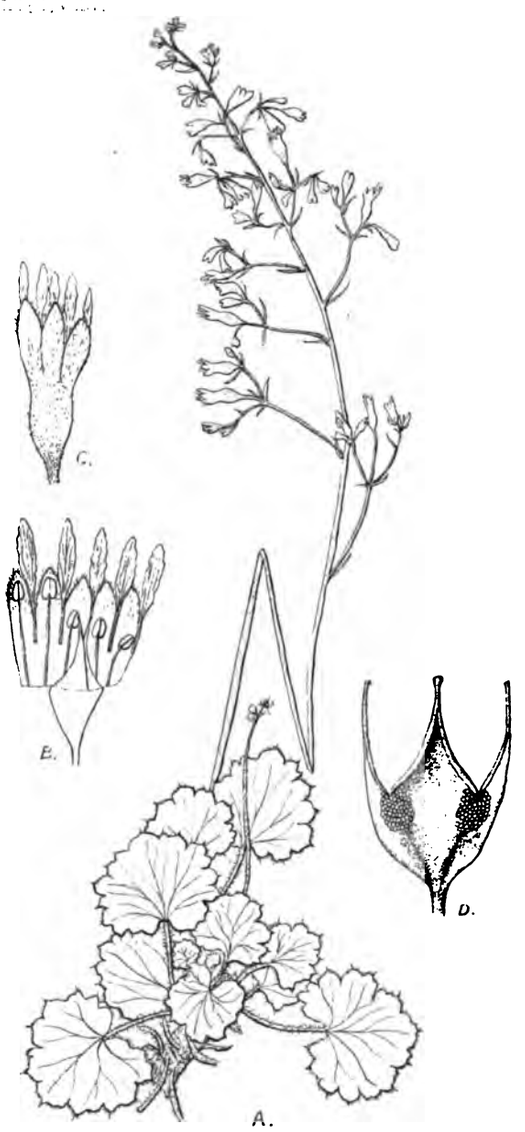
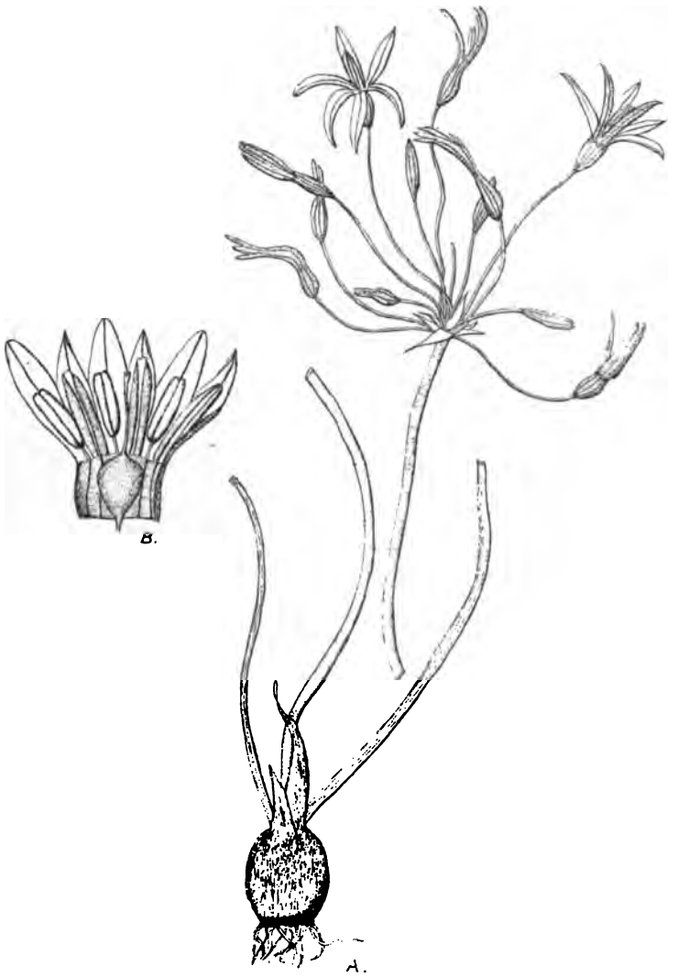
BRITTON & REY LITH.



LITH. PRESTON & REY, PHILA.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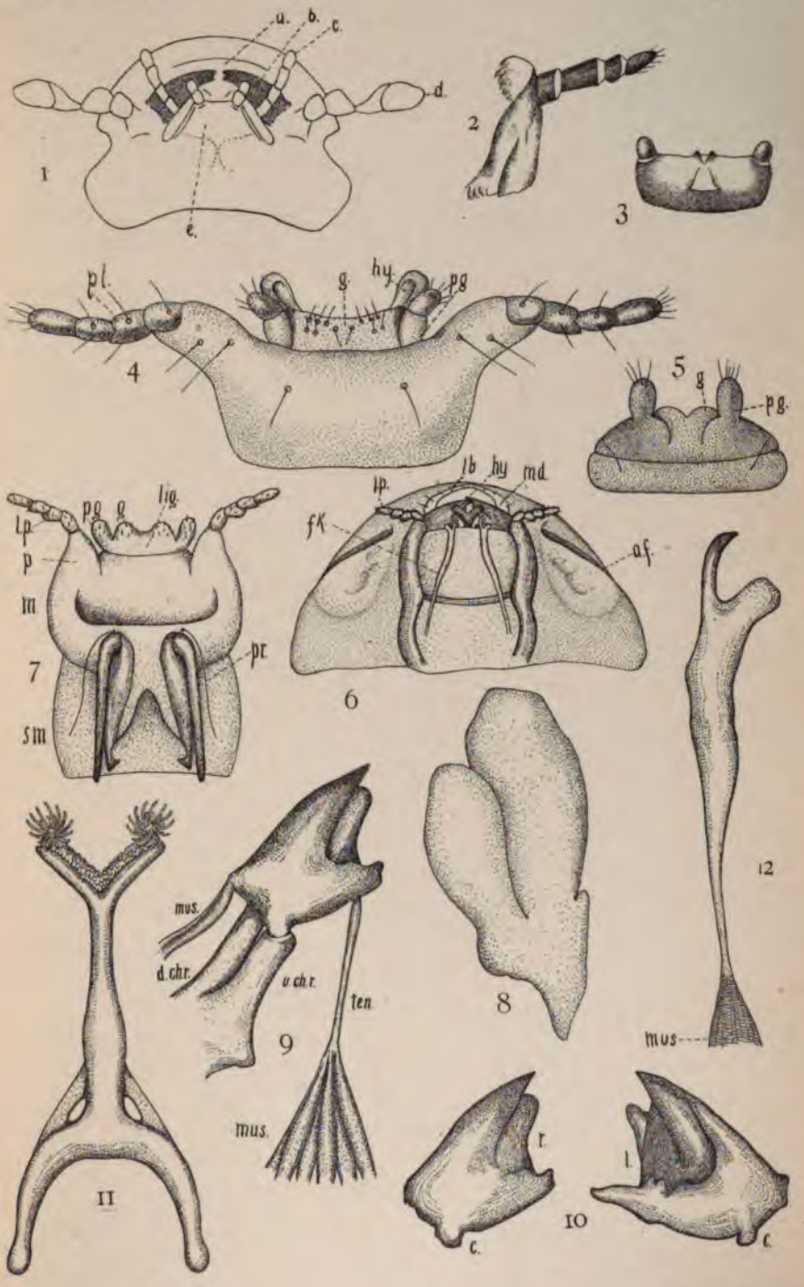
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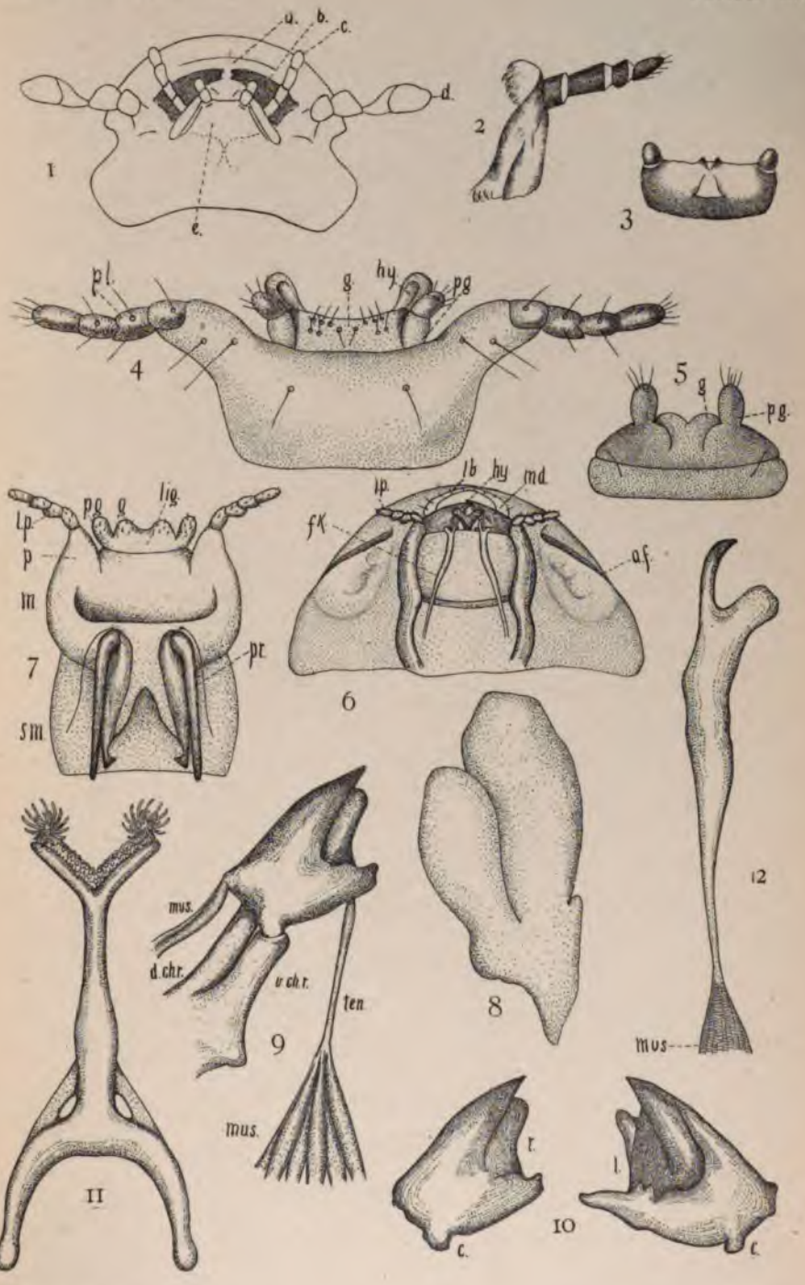
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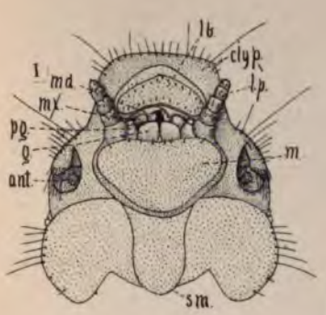
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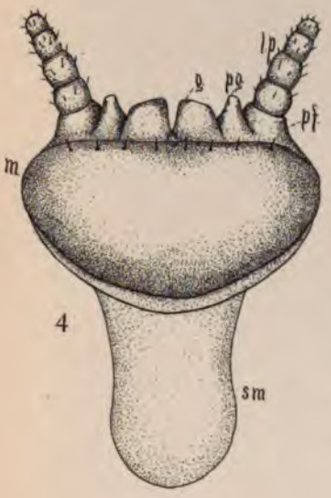
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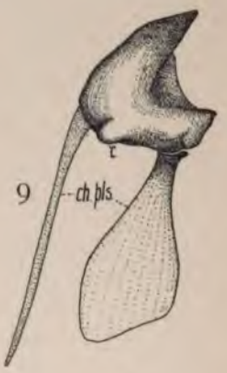
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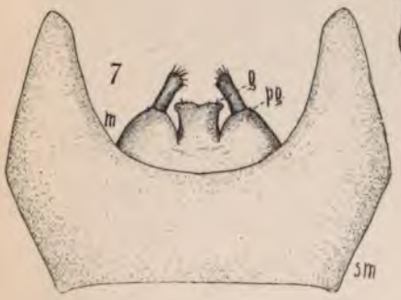
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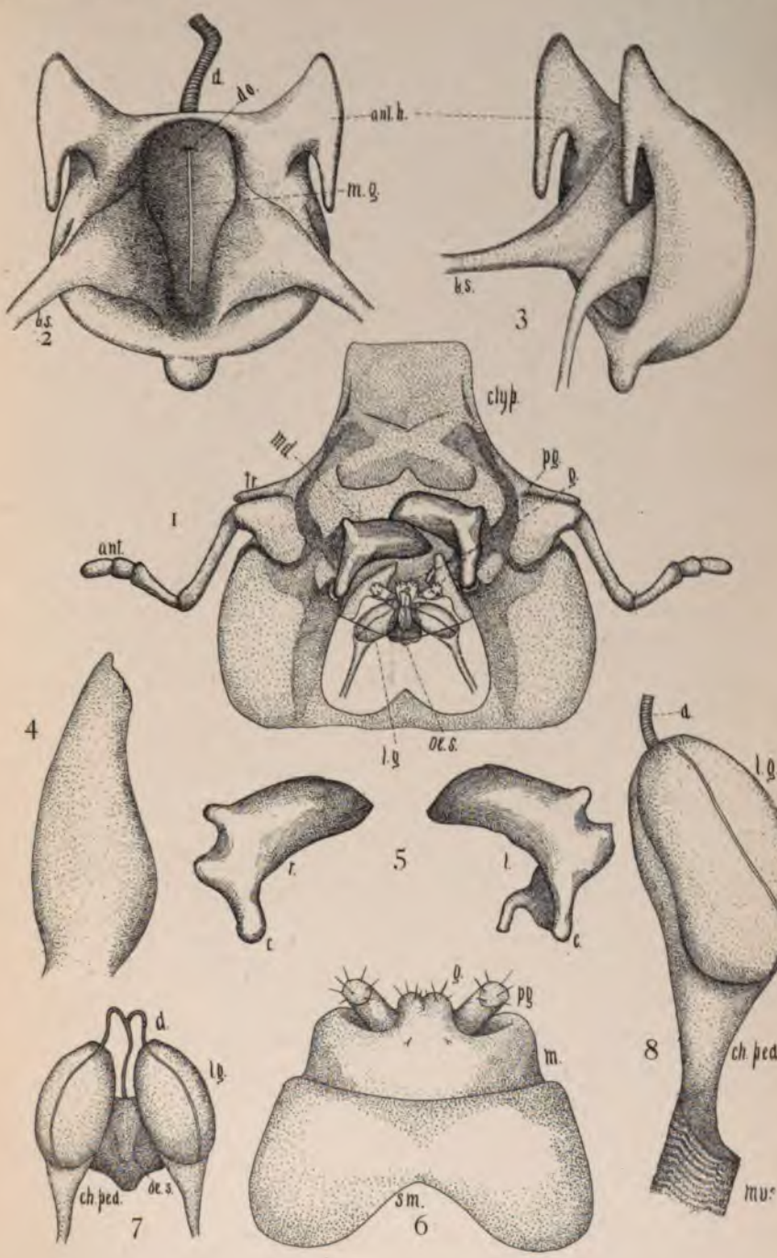
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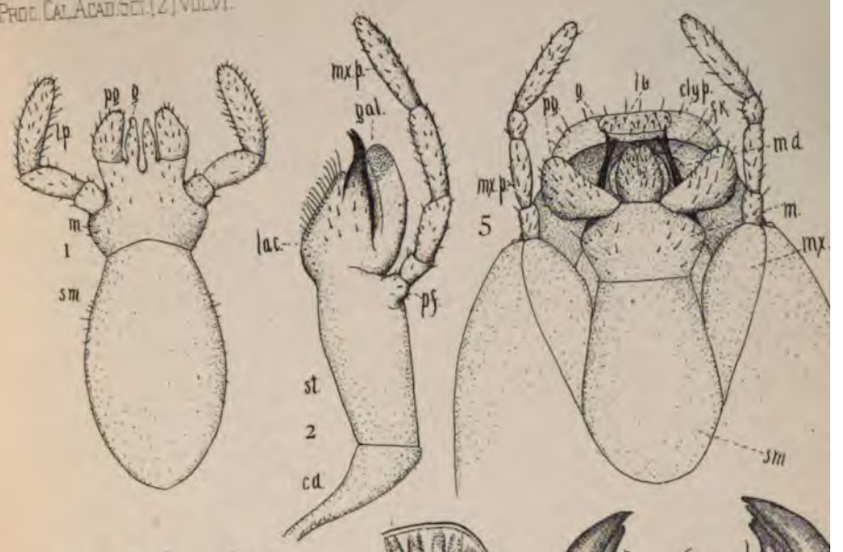
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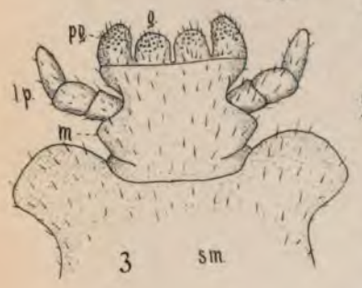
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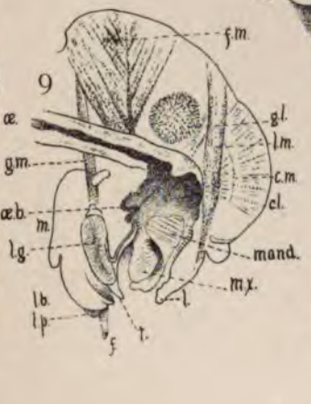
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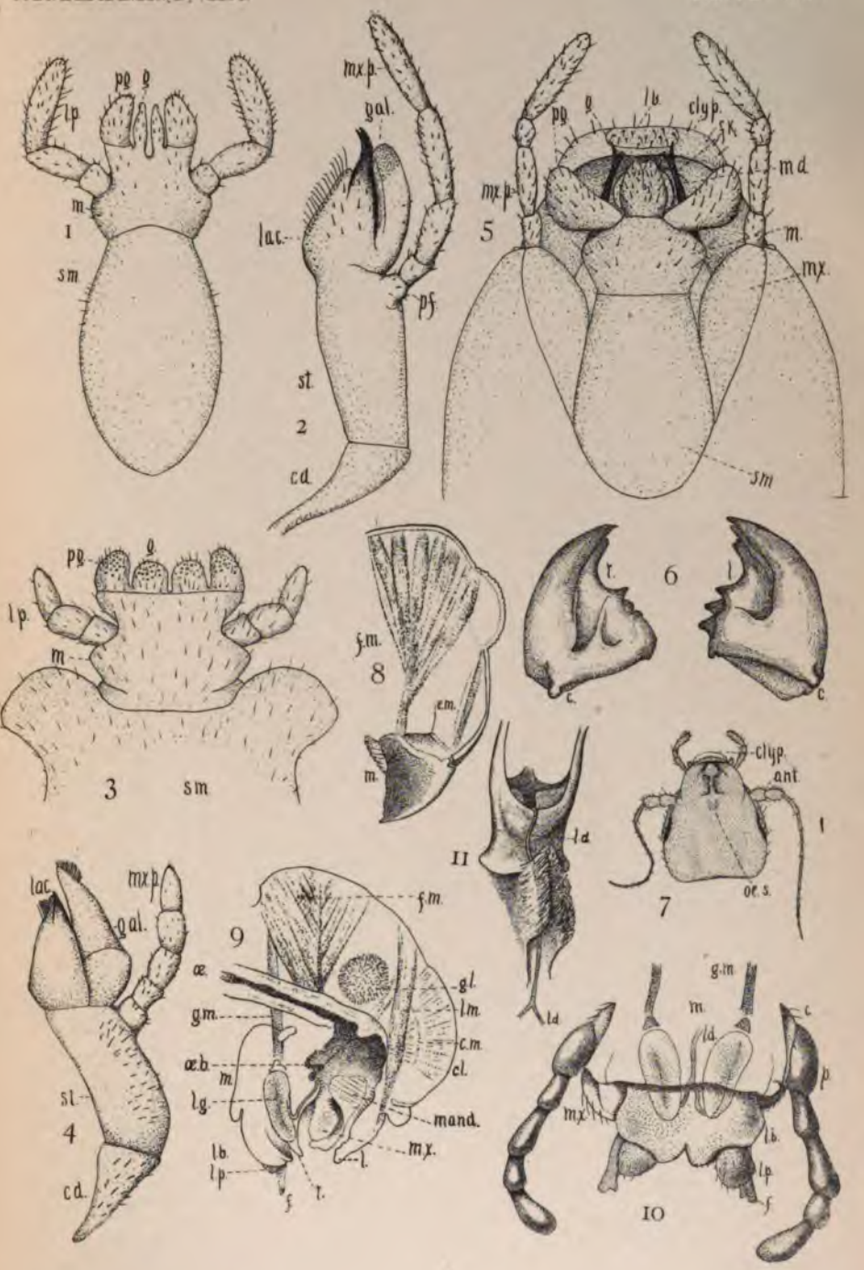
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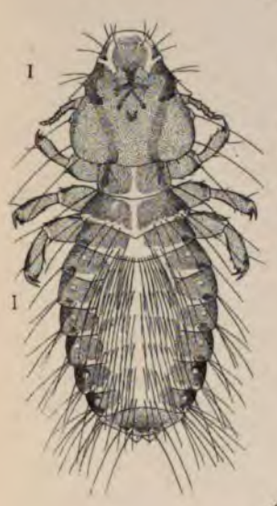
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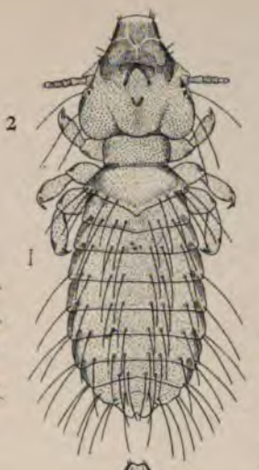
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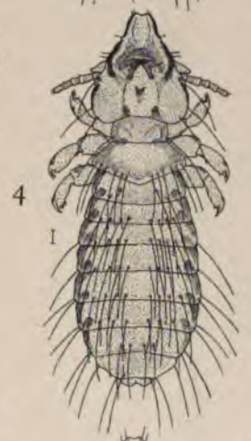
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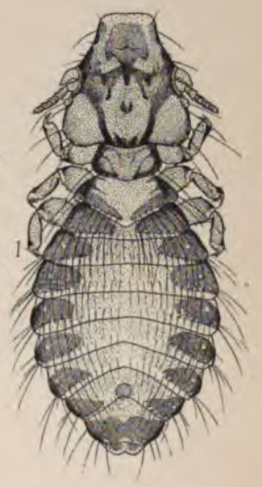
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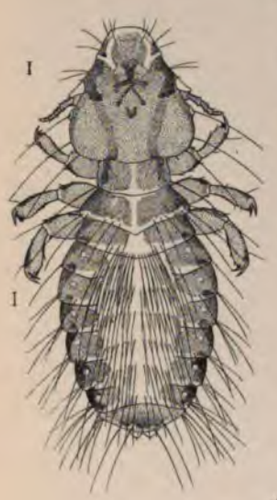
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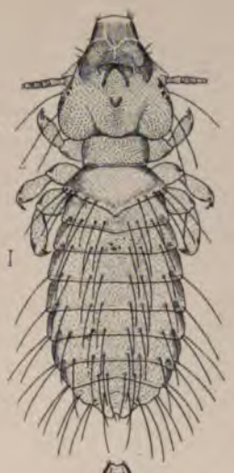
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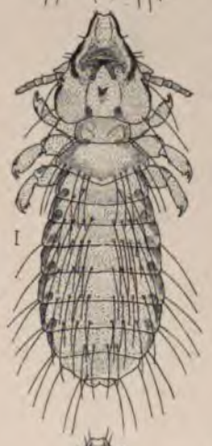
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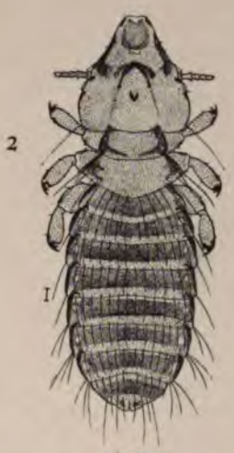
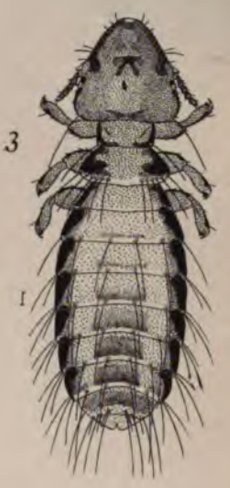
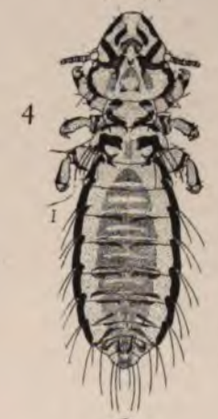
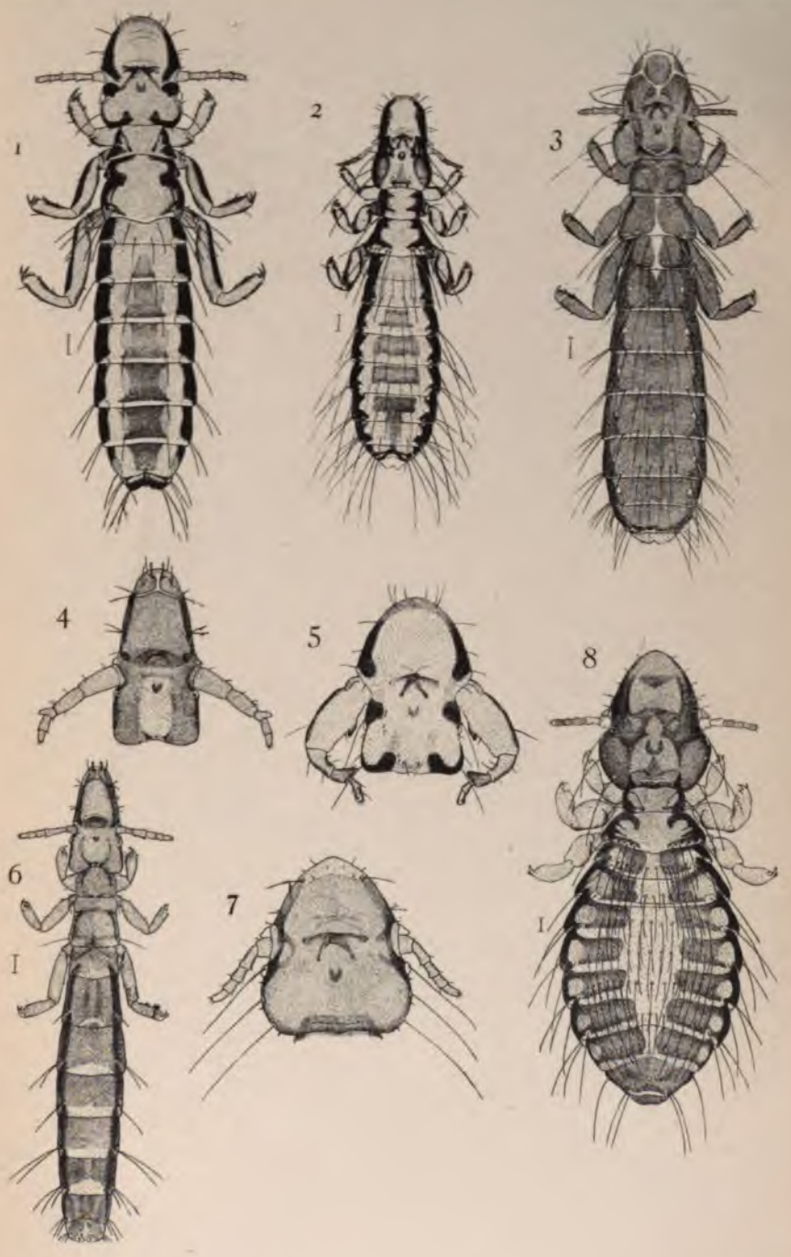






P. J. JACK, DEL.

LITH. BRITTON & REY. S.F.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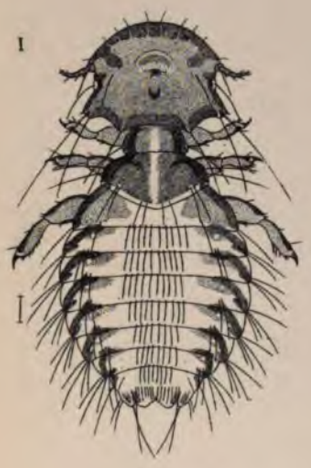
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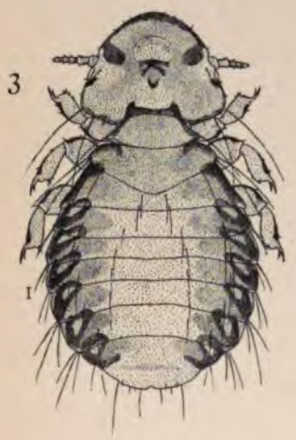
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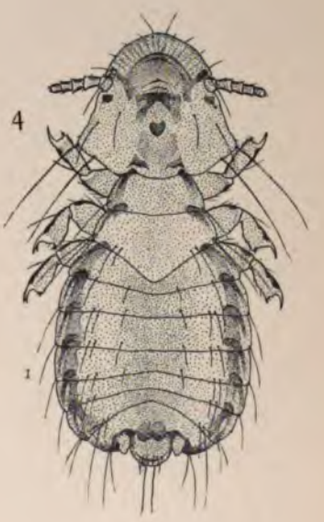
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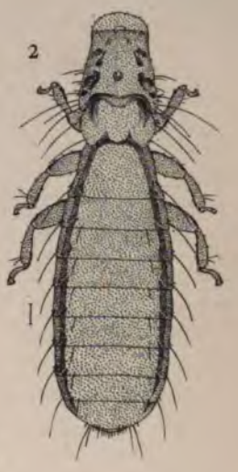

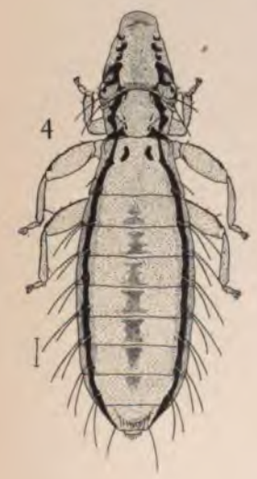

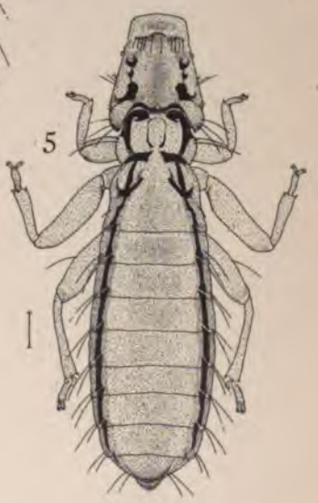

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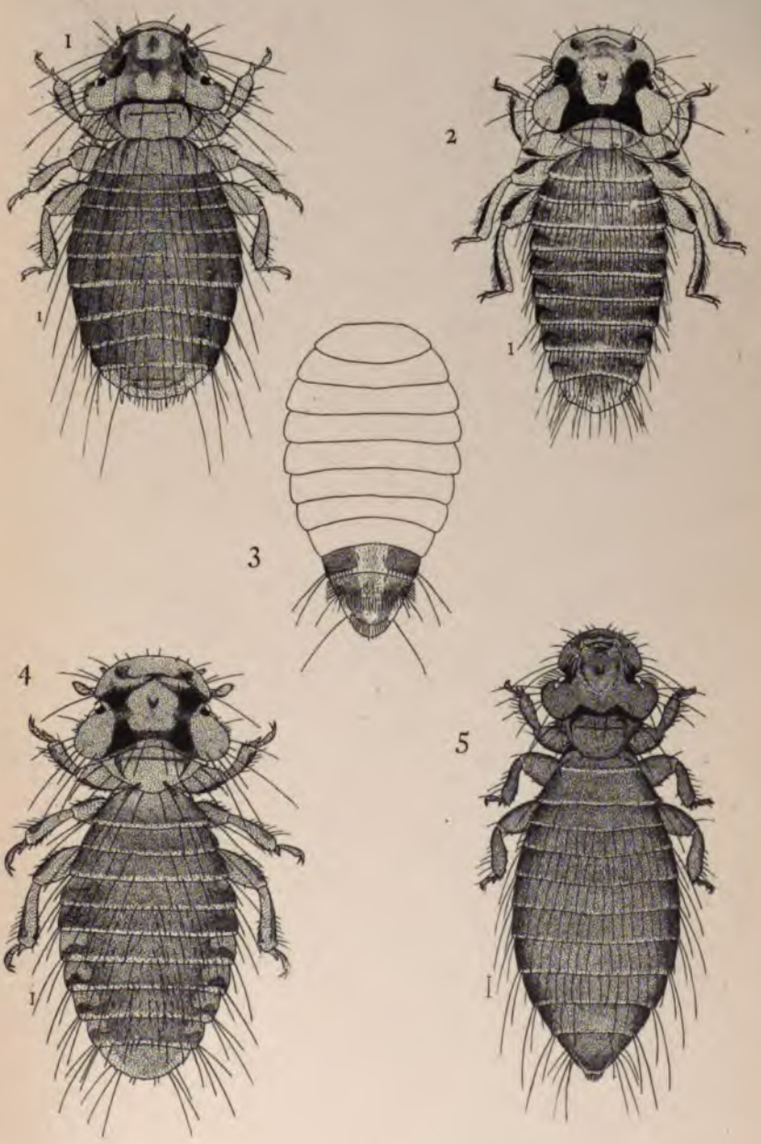

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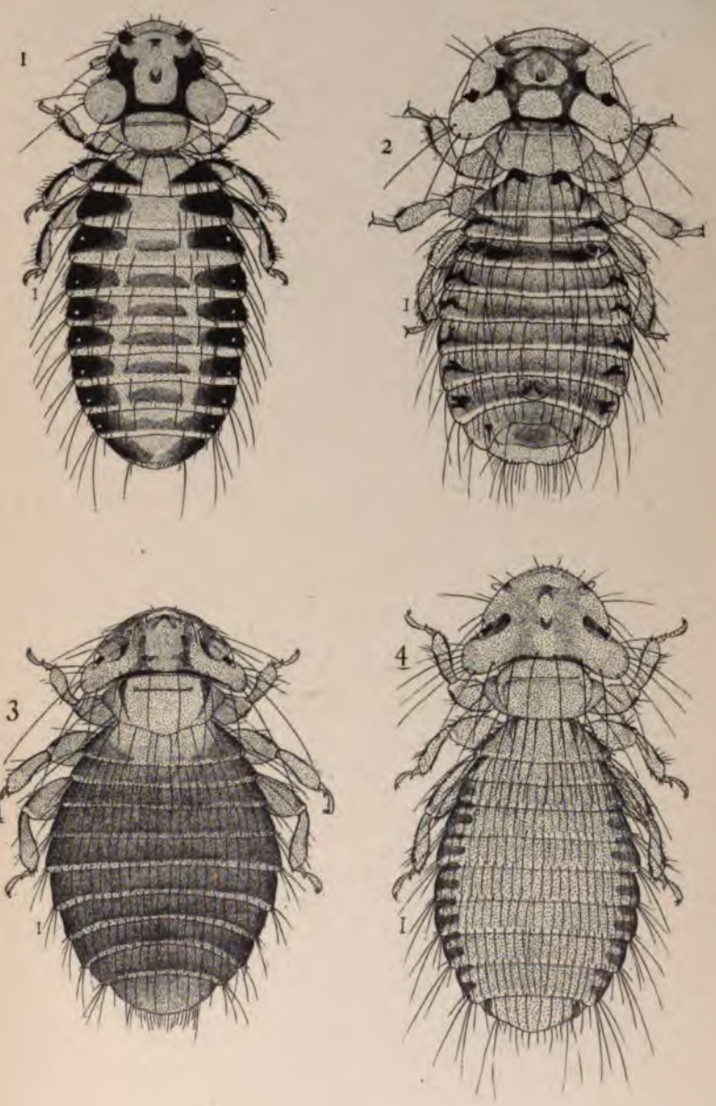

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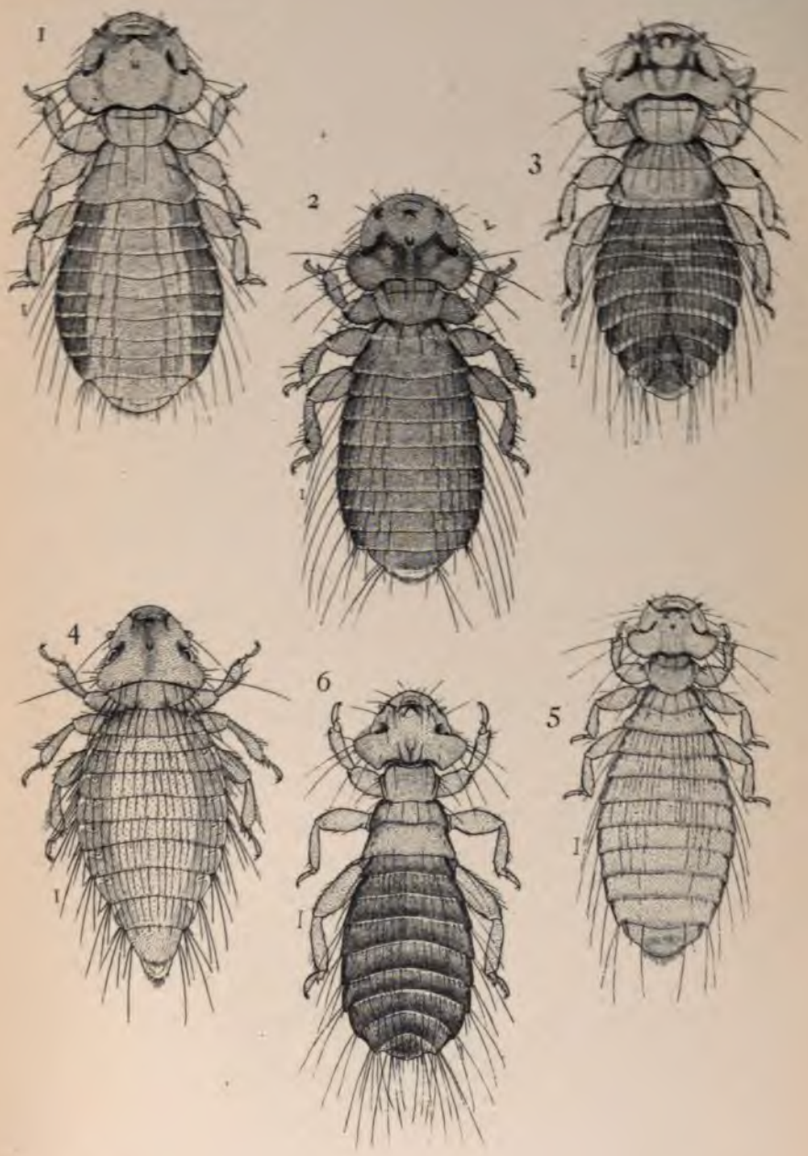
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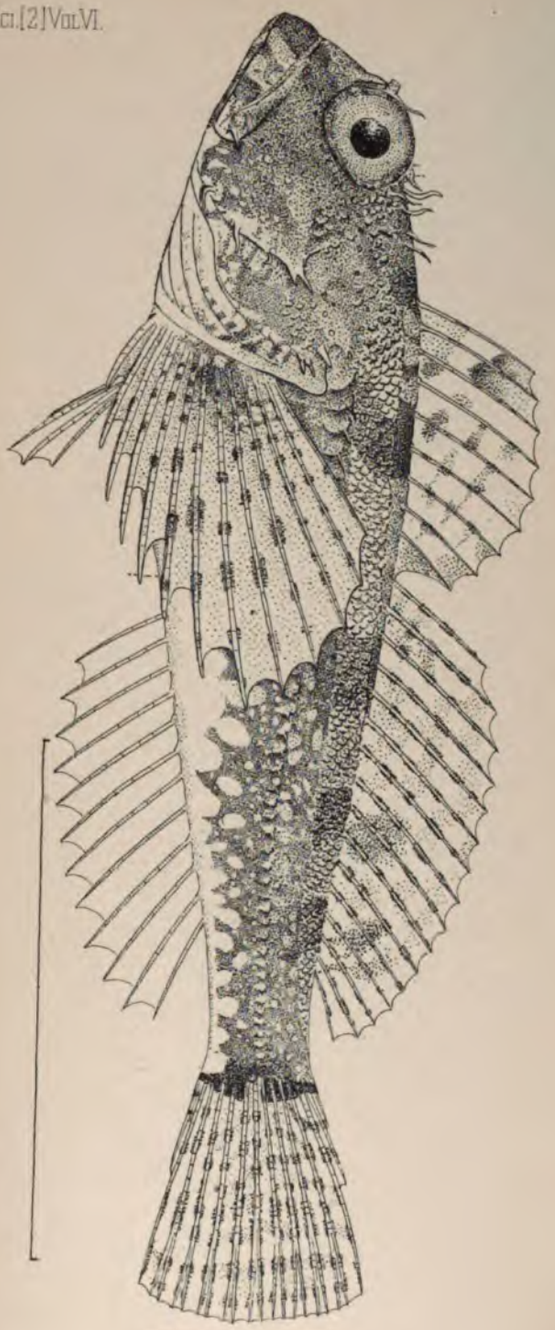

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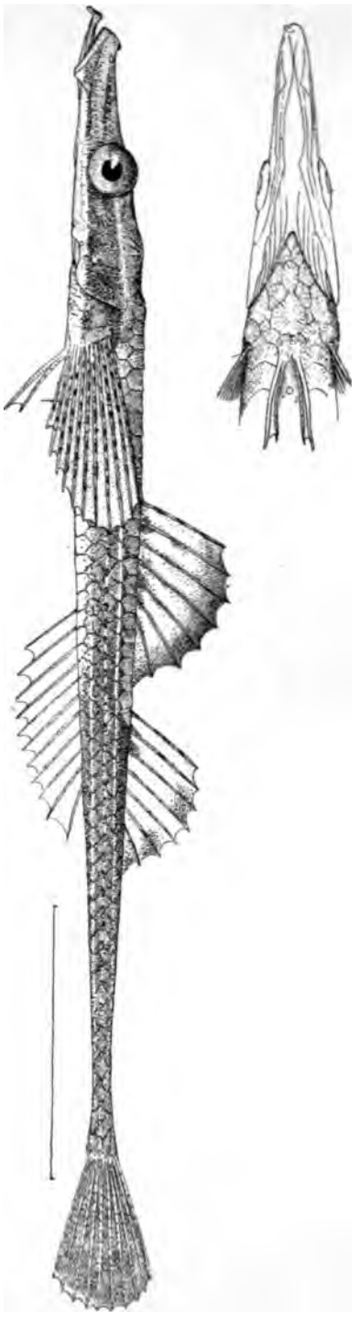

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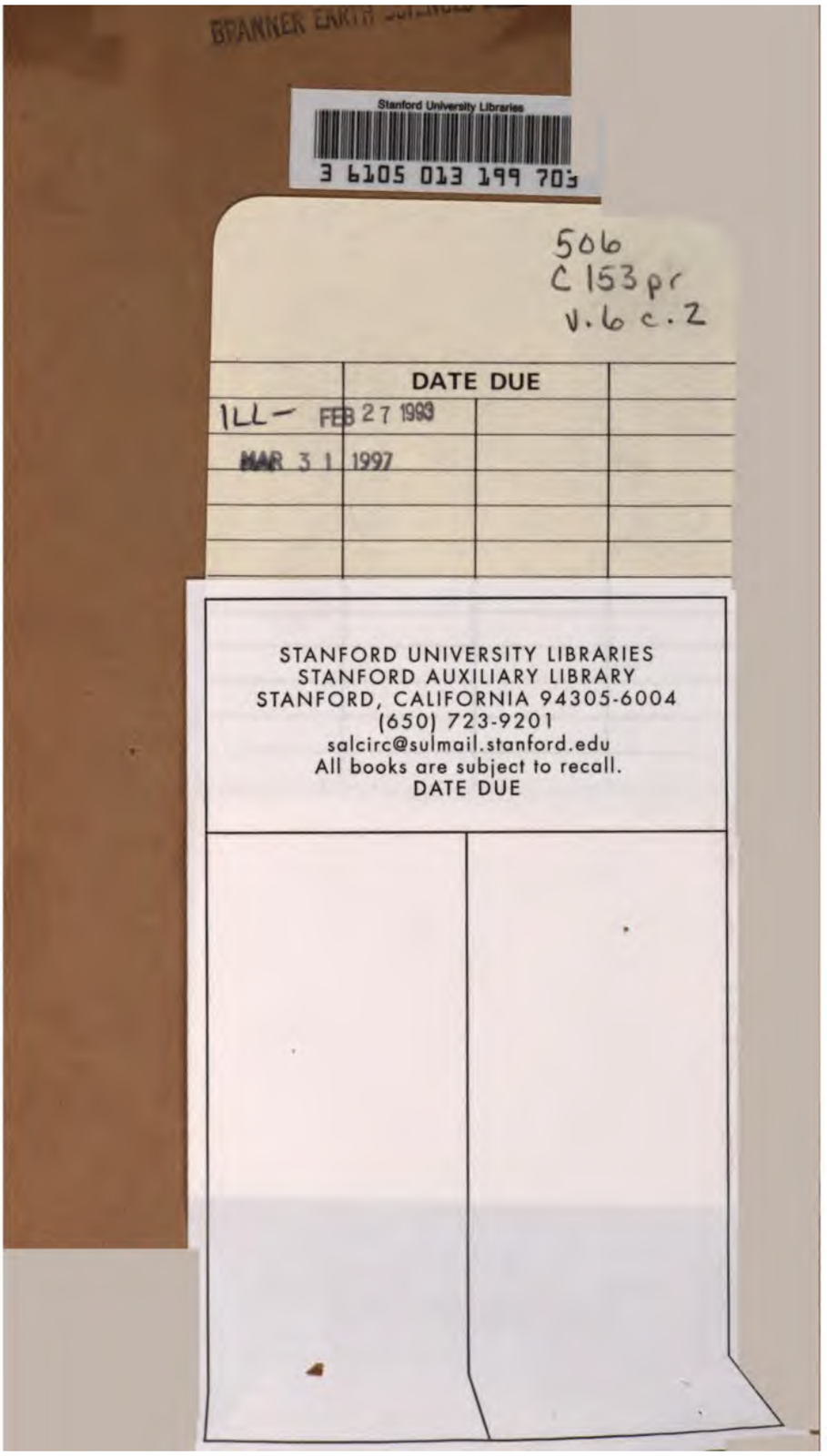
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